THE LIFECYCLE OF SOFTWARE OBJECTS

TED CHIANG

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Annotation

Ted Chiang has made his bones in SF as a master of the short story, so a much longer work than is customary comes as a surprise. "The typical science-fiction depiction of AI is this loyal, obedient butler; you simply flip a switch, turn it on and it's ready to do your bidding. I feel like there's a huge story being glossed over," Chiang tells Boing Boing about the genesis of The Lifecycle of Software Objects. To be sure, the ethical issues that he raises and the depth of the technology (even for a novella) overshadow character development and some hasty plotting. Chiang's distinctive voice is evident here — a tech-industry insider, he's always been fluent in geek-speak and has a knack for translating heavy ideas into workable plots — and his first foray into the long form is a success. It would be his readers' good fortune if the author decided to take up novel-writing full time.

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Ted Chiang
The Lifecycle of Software Objects

Chapter One

Her name is Ana Alvarado, and she's having a bad day. She spent all week preparing for a job interview, the first one in months to reach the videoconference stage, but the recruiter's face barely appeared onscreen before he told her that the company has decided to hire someone else. So she sits in front of her computer, wearing her good suit for nothing. She makes a halfhearted attempt to send queries to some other companies and immediately receives automated rejections. After an hour of this, Ana decides she needs some diversion: she opens a Next Dimension window to play her current favorite game, Age of Iridium.

The beachhead is crowded, but her avatar is wearing the coveted mother-of-pearl combat armor, and it's not long before some players ask her if she wants to join their fireteam. They cross the combat zone, hazy with the smoke of burning vehicles, and for an hour they work to clear out a stronghold of mantids; it's the perfect mission for Ana's mood, easy enough that she can be confident of victory but challenging enough that she can derive satisfaction from it. Her teammates are about to accept another mission when a phone window opens up in the corner of Ana's video screen. It's a voice call from her friend Robyn, so Ana switches her microphone over to take the call.

"Hey Robyn."

"Hi Ana. How's it going?"

"I'll give you a hint: right now I'm playing AoI."

Robyn smiles. "Had a rough morning?"

"You could say that." Ana tells her about the canceled interview.

"Well, I've got some news that might cheer you up. Can you meet me in Data Earth?"

"Sure, just give me a minute to log out."

"I'll be at my place."

"Okay, see you soon." Ana excuses herself from the fireteam and closes her Next Dimension window. She logs on to Data Earth, and the window zooms in to her last location, a dance club cut into a giant cliff face. Data Earth has its own gaming continents — Elderthorn, Orbis Tertius — but they aren't to Ana's taste, so she spends her time here on the social continents. Her avatar is still wearing a party outfit from her last visit; she changes to more conventional clothes and then opens a portal to Robyn's home address. A step through and she's in Robyn's virtual living room, on a residential aerostat floating above a semicircular waterfall a mile across.

Their avatars hug. "So what's up?" says Ana.

"Blue Gamma is up," says Robyn. "We just got another round of

funding, so we're hiring. I showed your resume around, and everyone's excited to meet you."

"Me? Because of my vast experience?" Ana has only just completed her certificate program in software testing. Robyn taught an introductory class, which is where they met.

"Actually, that's exactly it. It's your last job that's got them interested."

Ana spent six years working at a zoo; its closure was the only reason she went back to school. "I know things get crazy at a startup, but I'm sure you don't need a zookeeper."

Robyn chuckles. "Let me show you what we're working on. They said I could give you a peek under NDA."

This is a big deal; up until now, Robyn hasn't been able to give any specifics about her work at Blue Gamma. Ana signs the NDA, and Robyn opens a portal. "We've got a private island; come take a look." They walk their avatars through.

Ana's half expecting to see a fantastical landscape when the window refreshes, but instead her avatar shows up in what looks at first glance to be a daycare center. On second glance, it looks like a scene from a children's book: there's a little anthropomorphic tiger cub sliding colored beads along a frame of wires; a panda bear examining a toy car; a cartoon version of a chimpanzee rolling a foam rubber ball.

The onscreen annotations identify them as digients, digital organisms that live in environments like Data Earth, but they don't look like any that Ana's seen before. These aren't the idealized pets marketed to people who can't commit to a real animal; they lack the picture-perfect cuteness, and their movements are too awkward. Neither do they look like inhabitants of Data Earth's biomes: Ana has visited the Pangaea archipelago, seen the unipedal kangaroos and bidirectional snakes that evolved in its various hothouses, and these digients clearly didn't originate there.

"This is what Blue Gamma makes? Digients?"

"Yes, but not ordinary digients. Check it out." Robyn's avatar walks over to the chimp rolling the ball and crouches down in front of it. "Hi Pongo. Whatcha doing?"

"Pongo pliy bill," says the digient, startling Ana.

"Playing with the ball? That's great. Can I play too?"

"No. Pongo bill."

"Please?"

The chimp looks around and then, never letting go of the ball, toddles over to a scattering of wooden blocks. It nudges one of them in Robyn's direction. "Robyn pliy blicks." It sits back down. "Pongo pliy bill."

“Okay then.” Robyn walks back over to Ana.”What do you think?”

“That’s amazing. I didn’t know digients had come so far.”

“It’s all pretty recent; our dev team hired a couple of PhDs after seeing their conference presentation last year. Now we’ve got a genomic engine that we call Neuroblast, and it supports more cognitive development than anything else currently out there. These fellows here”—she gestures at the daycare center inhabitants—”are the smartest ones we’ve generated so far.”

“And you’re going to sell them as pets?”

“That’s the plan. We’re going to pitch them as pets you can talk to, teach to do really cool tricks. There’s an unofficial slogan we use in-house: ‘All the fun of monkeys, with none of the poop-throwing.’”

Ana smiles. “I’m starting to see where an animal-training background would be handy.”

“Yeah. We aren’t always able to get these guys to do what they’re told, and we don’t know how much of that is in the genes and how much is just because we aren’t using the right techniques.”

She watches as the panda-shaped digient picks up the toy car with one paw and examines the underside; with its other paw it cautiously bats at the wheels. “How much do these digients start out knowing?”

“Practically nothing. Let me show you.” Robyn activates a video screen on one wall of the daycare center; it displays footage of a room decorated in primary colors with a handful of digients lying on the floor. Physically they’re no different from the ones in the daycare center now, but their movements are random, spasmodic. “These guys are newly instantiated. It takes them a few months subjective to learn the basics: how to interpret visual stimuli, how to move their limbs, how solid objects behave. We run them in a hothouse during that stage, so it all takes about a week. When they’re ready to learn language and social interaction, we switch to running them in real time. That’s where you would come in.”

The panda pushes the toy car back and forth across the floor a few times, and then makes a braying sound, *mo mo mo*. Ana realizes that the digient is laughing. Robyn continues, “I know you studied primate communication in school. Here’s a chance to put that to use. What do you think? Are you interested?”

Ana hesitates; this is not what she envisioned for herself when she went to college, and for a moment she wonders how it has come to this. As a girl she dreamed of following Fossey and Goodall to Africa; by the time she got out of grad school, there were so few apes left that her best option was to work in a zoo; now she’s looking at a job as a trainer of virtual pets. In her career trajectory you can see the

diminution of the natural world, writ small.

Snap out of it, she tells herself. It may not be what she had in mind, but this is a job in the software industry, which is what she went back to school for. And training virtual monkeys might actually be more fun than running test suites, so as long as Blue Gamma is offering a decent salary, why not?

#

His name is Derek Brooks, and he's not happy with his current assignment. Derek designs the avatars for Blue Gamma's digients, and normally he enjoys his job, but yesterday the product managers asked him for something he considers a bad idea. He tried to tell them that, but the decision is not his to make, so now he has to figure out how to do a decent job of it.

Derek studied to be an animator, so in one respect creating digital characters is right up his alley. In other respects, his job is very different from that of a traditional animator. Normally he'd design a character's gait and its gestures, but with digients those traits are emergent properties of the genome; what he has to do is design a body that manifests the digients' gestures in a way that people can relate to. These differences are why a lot of animators — including his wife Wendy — don't work on digital lifeforms, but Derek loves it. He feels that helping a new lifeform express itself is the most exciting work an animator could be doing.

He subscribes to Blue Gamma's philosophy of AI design: experience is the best teacher, so rather than try to program an AI with what you want it to know, sell ones capable of learning and have your customers teach them. To get customers to put in that kind of effort, everything about the digients has to be appealing: their personalities need to be charming, which the developers are working on, and their avatars need to be cute, which is where Derek comes in. But he can't simply give the digients enormous eyes and short noses. If they look like cartoons, no one will take them seriously. Conversely, if they look too much like real animals, their facial expressions and ability to speak become disconcerting. It's a delicate balancing act, and he has spent countless hours watching reference footage of baby animals, but he's managed to design hybrid faces that are endearing but not exaggeratedly so.

His current assignment is a bit different. Not satisfied with cats, dogs, monkeys, and pandas, the product managers have decided that there needs to be more variety among the avatars, something other than baby animals. They suggest robots.

The idea makes no sense to Derek. Blue Gamma's entire strategy relies on people's affinity for animals. The digients learn through positive reinforcement, the way animals do, and their rewards include

interactions like being scratched on the head or receiving virtual food pellets. These make perfect sense with an animal avatar, but with a robot avatar they look comical and forced. If they were selling physical toys, robots would have the advantage of being cheaper to build than plausible animals, but production costs don't matter in the virtual realm, and animal faces are more expressive. Providing robotic avatars seems like offering imitations at the same time that you're selling the real thing.

His train of thought is interrupted by a knock at his doorway; it's Ana, the new member of the testing team. "Hey Derek, you should watch the video of this morning's training session. They were pretty funny."

"Thanks, I'll check them out." She's about to leave, but then stops. "You look like you're having a bad day."

Derek thinks hiring a former zookeeper was a good idea. Not only did she devise a training program for the digients, she had a great suggestion about improving their food.

Other digient vendors provide a limited variety of digient food pellets, but Ana suggested that Blue Gamma radically open up the forms that digient food takes; she pointed out that a varied diet keeps zoo animals happier and makes feeding time more fun for visitors. Management agreed, and the development team edited the digients' basic reward map to recognize a wide range of virtual foods; they couldn't actually simulate different chemical compounds — Data Earth's physics simulation is nowhere near good enough for that — but they added parameters to stand in for a food's taste and texture, and designed an interface for the food-dispensing software allowing users to concoct their own recipes. It's turned out to be a big success; the individual digients each have their own favorites, and the beta testers report that they love catering to their digient's preferences.

"Management decided that the animal avatars aren't enough," says Derek. "They want robot avatars, too. Can you believe it?"

"That sounds like a good idea," says Ana.

He's surprised. "You really think so? I'd have thought you'd prefer the animal avatars."

"Everyone here thinks of the digients as animals," she says."The thing is, the digients don't behave like any real animal. They've got this non-animal quality to them, so it feels like we're dressing them in circus costumes when we try to make them look like monkeys or pandas."

It hurts a little to hear his carefully crafted avatars compared to circus costumes. His face must give him away because she adds, "Not that the average person would notice. It's just that I've spent a lot more time with animals than most people."

“That’s okay,” he says.”I appreciate hearing a different perspective.”

“Sorry. The avatars look great, honestly. I like the tiger cub especially.”

“It’s fine. Really.”

She gives an apologetic wave and walks down the hall, while Derek thinks about what she said.

Perhaps he’s gotten too wrapped up in the animal avatars, so much so that he’s begun thinking of the digients as something they’re not. Ana’s right, of course, that the digients aren’t animals any more than they’re traditional robots, and who’s to say that either analogy is more accurate than the other? If he works from the premise that a robotic avatar is just as good a way for this new lifeform to express itself as an animal avatar, then perhaps he’ll be able to design an avatar he’s happy with.

#

A year later, and Blue Gamma is days away from its big product launch. Ana is at work in her cubicle, across the aisle from Robyn’s; they sit with their backs to each other, but right now both of their video screens are displaying Data Earth, where their avatars stand side by side. Nearby, a dozen digients scamper around a playground, chasing each other over a tiny bridge or under it, climbing up a short flight of steps and sliding down a ramp. These digients are the release candidates; in a few days, they — or close approximations thereof — will be available for purchase to customers throughout the overlapping realms of the real world and Data Earth.

Rather than teach the digients any new behaviors at this late date, Ana and Robyn are supposed to keep the digients in practice with what they’ve already learned. They’re in the middle of a session when Mahesh, one of the co-founders of Blue Gamma, walks past their cubicles. He pauses to watch. “Don’t mind me; keep doing what you’re doing. What’s today’s skill?”

“Shape identification,” says Robyn. She instantiates a scattering of colored blocks on the ground in front of her avatar. To one of the digients, she says, “Come here, Lolly.” A lion cub toddles over from the playground.

Meanwhile Ana calls over Jax, whose avatar is a neo-Victorian robot made of polished copper. Derek did a great job designing it, from the proportions of the limbs to the shape of the face; Ana thinks Jax is adorable. She likewise instantiates a selection of colored blocks with different shapes, and directs Jax’s attention to them.

“See the blocks, Jax? What shape is the blue one?”

“Tringle,” says Jax.

“Good. What shape is the red one?”

“Squir.”

“Good. What shape is the green one?”

“Circle.”

“Good job, Jax.” Ana gives him a food pellet, which he devours with enthusiasm.

“Jax smirt,” says Jax.

“Lolly smirt too,” Lolly volunteers.

Ana smiles and rubs them on the backs of their heads. “Yes, you’re both very smart.”

“Both smirt,” says Jax.

“That’s what I like to see,” says Mahesh.

The release candidates are the final distillation of countless trials, the cream of the crop in terms of teachability. It’s partly been a search for intelligence, but just as much it’s been a search for temperament, the personality that won’t frustrate customers. One element of that is the ability to play well with others. The development team has tried to reduce hierarchical behavior in the digients — Blue Gamma wants to sell a pet that owners won’t need to continually reassert their dominance over — but that doesn’t mean competition never arises. The digients love attention, and if one notices that Ana’s giving praise to another, it tries to get in on the action. Most of the time this is fine, but whenever a digient seemed particularly resentful of its peers or of Ana, she would flag it and its specific genome would be excluded from the next generation. The process has felt a bit like breeding dogs, but more like working in an enormous test kitchen, baking endless batches of brownies and sampling each one’s toothsomeness to find the perfect recipe.

The current instances of the release candidates will be kept as mascots, and copies will be available for purchase, but the expectation is that most people will buy younger digients, when they’re still prelinguistic. Teaching your digient how to talk is half the fun; the mascots primarily serve as examples of the kind of results you can expect. Selling prelinguistic digients also allows them to be sold in non-English-speaking markets, even though Blue Gamma only had enough staff to raise mascots in English.

Ana sends Jax back to the playground, and calls over a panda-bear digient named Marco. She’s about to start testing his shape recognition when Mahesh points to one corner of her video screen. “Hey, look at that.” A couple of digients are on the hill next to the playground, rolling down the slope.

“Hey, cool,” she says. “I’ve never seen them do that before.” She walks her avatar over to the hill, with Jax and Marco following and then joining the rest of the digients. The first time Jax tries it, he stops rolling almost immediately, but after a little practice he’s able to make

it all the way down the hill. He does that a few times and then runs back to Ana.

"Ana watch?" asks Jax. "Jax spinning lying din!"

"Yes, I saw you! You were rolling down the hill!"

"Rilling din hill!"

"You did great." She rubs him on the back of his head again. Jax runs back and resumes rolling. Lolly has also taken to the new activity with enthusiasm. Once she's reached the bottom of the hill, she keeps rolling across the flat ground, and then hits one of the playground bridges.

"Eeh, eeh, eeh," Lolly says. "Fuck." Suddenly everyone's attention is on Lolly. "Where did she learn that?" asks Mahesh.

Ana toggles her microphone off, and walks her avatar over to comfort Lolly. "I don't know," she says. "She must have overheard it."

"Well, we can't sell a digient that says 'fuck.'"

"I'm on it," says Robyn. In a separate window on her own screen, she brings up the archives of their training sessions and runs a search on the audio track. "Looks like that's the first time any of the digients has said it. As for when any of us has said it…" The three of them watch as search results accumulate in the window; it appears that the culprit is Stefan, one of the trainers from Blue Gamma's Australian office. Blue Gamma has people working in Australia and England to train the digients when the West Coast office is closed; the digients don't need to sleep — or, more precisely, the integration processing that's their analog to sleep can be run at high speed — so they can be trained twenty-four hours a day.

They review the video footage of every time Stefan said the word 'fuck' during a training session. The most dramatic outburst is from three days ago; it's hard to be sure from watching his Data Earth avatar, but it sounds like he banged his knee against his desk. There are previous examples going weeks back, but none as loud or prolonged.

"What do you want us to do?" asks Robyn.

The tradeoff is apparent. This close to the release date, they don't have time to repeat weeks of training; should they gamble that the earlier utterances didn't make an impression on the digients? Mahesh thinks for a moment, and then decides. "Okay. Roll them back three days and pick up from there."

"All of them?" says Ana. "Not just Lolly?"

"We can't take the chance; roll them all back. And I want a keyword flagger running on every training session from now on. The next time any of you curses, roll all of them back to the last checkpoint."

So the digients lose three days of experience. Including the first

time they rolled down a hill.

Chapter Two

Blue Gamma's digients are a hit. Within the first year of release, a hundred thousand customers buy them and — more importantly — keep them running. Blue Gamma is gambling on a "razor and blades" business model, because just selling the digients wouldn't recoup the development costs; instead, the company charges customers each time they make digient food, and thus maintains a revenue stream for as long as the digients remain entertaining to their owners. And so far, the customers are finding them enormously entertaining, keeping them running all day long. It's common for customers to run the integration processing slowly, so the digients sleep the entire night, but some run it at high speed, so their digients are awake almost all the time; they share their digients in cooperation with people in other time zones, enabling them to mature more rapidly. Scores of digient playgrounds and daycare centers appear across Data Earth's social continents, and public-events calendars become dotted with group playdates, training classes, and talent contests. Some owners even bring their digients to the racing zones and let them ride in their vehicles. The virtual world acts as a global village for raising the digients, a social fabric into which a new category of pet is woven.

Half of the digients that Blue Gamma sells are one-offs, having a genome that's randomly generated while remaining within the parameters chosen during the breeding process. The other half are copies of the mascots, but the company takes pains to remind buyers that each copy will develop differently depending on its environment. As an illustration of this, Blue Gamma's sales team points to Marco and Polo, two of the company's mascots. Both are instances of the exact same genome and both have panda-bear avatars, but they have distinctly different personalities. Marco was two years old when Polo was instantiated, and Polo latched on to him as a kind of older brother; the two are inseparable now, but Marco is more outgoing while Polo is more cautious, and no one expects that Polo will turn into Marco any time soon.

Blue Gamma's mascots are the oldest Neuroblast digients running, and management originally hoped they would provide the test team with a preview of digient behavior before customers encountered it. In practice, it hasn't worked out that way; there's no way to predict how digients raised in a thousand different settings will turn out. In a very real sense, each digient owner is exploring new territory, and they turn to each other for help. Online forums for digient owners spring up, filled with anecdotes and discussion, advice sought and given.

Blue Gamma has a customer liaison whose job is to read the

forums, but Derek sometimes follows the forums on his own, after work. Sometimes customers talk about the digients' facial expressions, but even when they don't, Derek enjoys reading the anecdotes.

> **FROM: Zoe Armstrong**
> You won't believe what my Natasha did today! We were at the playground, and another digient hurt himself when he fell and was crying. Natasha gave him a hug to make him feel better, and I praised her to high heaven. Next thing I know, she pushes over another digient to make him cry, hugs him, and looks to me for praise!

The next post he reads attracts his attention:

> **FROM: Andrew Nguyen**
> Are some of the digients just not as smart as others? My digient doesn't respond to my commands the way I've seen other people's do.

He looks at the customer's public profile, and sees that the avatar is an endless shower of gold coins; the coins bounce off each other so that their trajectories suggest a highly abstract human figure. It's a dazzling piece of animation, but Derek suspects that the user hasn't read Blue Gamma's recommendations on raising the digients. He posts a reply:

> **FROM: Derek Brooks**
> When you're playing with your digient, are you wearing the avatar that's displayed in your profile? If you are, one problem is that your avatar doesn't have a face. Set your camera to track your facial expressions and wear an avatar that can display them, and you'll get a much better response from your digient.

He continues to browse. A minute later, he sees another question that he finds interesting:

> **FROM: Natalie Vance**
> My digient Coco is a Lolly, a year-and-a-half old. Lately she's been really naughty. Never does what I tell her to, driving me crazy. She was an absolute doll a few weeks ago, so I tried restoring her from a checkpoint, but it doesn't last. I've tried it twice now, and she still ends up with the same naughty attitude. (It took a little longer the second time, though.) Has anyone had a similar experience? I'm especially

interested if you have a Lolly. How far back did you need to roll back to get around the problem?

There are several replies in which people suggest ways to isolate what specifically triggered Coco's change in mood and then work around it. He's about to post a reply of his own, to the effect that a digient is not a videogame that you replay until you get a perfect score, when he sees a response from Ana:

FROM: Ana Alvarado

I can sympathize, because I've seen the exact same thing. It's not specific to the Lollys, it's something that a lot of digients go through. You can keep trying to work around episodes like this, but I suspect they're unavoidable, and you'll just wind up spending months on a digient that never gets any older. Or you can push through the rough patch and have a more mature digient when you come out the other side.

He's heartened to read this. The practice of treating conscious beings as if they were toys is all too prevalent, and it doesn't just happen to pets. Derek once attended a holiday party at his brother-in-law's house, and there was a couple there with an eight-year-old clone. He felt sorry for the boy every time he looked at him. The child was a walking bundle of neuroses, the result of growing up as a monument to his father's narcissism. Even a digient deserves more respect than that.

He sends Ana a private message, thanking her for her post. Then he notices that the customer with the faceless avatar has responded to his suggestion.

FROM: Andrew Nguyen

The hell with that. I paid good money for this avatar, and I bought it specifically to wear when I'm on the social continents. I'm not going to stop wearing it for a digient.

Derek sighs; there's probably no chance of changing the man's mind, but hopefully he'll just suspend his digient rather than do a bad job of raising it. Blue Gamma has done what it can to minimize abuses; all the Neuroblast digients are equipped with pain circuit-breakers, which renders them immune to torture and thus unappealing to sadists. Unfortunately, there's no way to protect the digients from things like simple neglect.

#

Over the next year, other companies begin marketing their own genomic engines that support language learning. None of them can match Neuroblast's popularity on the Data Earth platform, although on other platforms the situation is different. On Next Dimension, the Origami engine becomes dominant; on Anywhere, it's an engine called Faberge. Fortunately, Blue Gamma has inspired companies to offer complementary products as well as competing ones.

Today half of the company's employees are crowded into the reception area: managers, developers, testers, designers. They're here because a highly anticipated delivery has finally arrived; a shipping carton the size of a large suitcase sits in front of the receptionist's desk.

"Let's open it up," says Mahesh.

Ana and Robyn pull the tabs on the shipping carton, separating it into eight blocks of cellulose foam that hinge open. The resident of this custom sarcophagus is a robot body, newly arrived from the fabrication facility. The robot is humanoid in shape but small, less than three feet in height, to keep the inertia of its limbs low and allow it a moderate amount of agility. Its skin is glossy black and its head is disproportionately large, with a surface mostly occupied by a wraparound display screen.

The robot is from SaruMech Toys. A number of companies have sprung up to offer services targeting digient owners, but SaruMech is the first one with a hardware product instead of software. They've sent an example of their product to Blue Gamma in hopes of an endorsement.

"Which mascot got the high score?" asks Mahesh. He's referring to the agility trials. Last week all the digients were given test avatars whose weight distribution and range of motion matched the robot body's; they've spent some time each day wearing the avatars, practicing moving around in them. Yesterday Ana scored the digients on their ability to lay on their backs and then rise to their feet, ascend and descend stairs, balance on one leg and then the other. It was like conducting a sobriety test for a bunch of toddlers.

"That was Jax," says Ana.

"Okay, get him ready."

The receptionist relinquishes his workspace to Ana, who logs into Data Earth from there and calls Jax over. Jax is lucky because the test avatar isn't radically different from his own; it's bulkier, but the limbs and torso have similar proportions. By contrast, the digients who grew up wearing panda-bear and tiger-cub avatars have been having more difficulty.

Robyn checks the diagnostics panel on the robot. "Looks like we're good to go." Ana opens a portal in the gymnasium onscreen, and

gestures to Jax. “Okay Jax, come on in.”

Onscreen, Jax steps through the portal, and in the reception area the little robot comes alive. The robot’s head lights up to display Jax’s face, turning the oversized head into a bubble helmet he’s wearing. The design is a way of maintaining the resemblance to the digient’s original avatar without having to produce custom bodies. Jax looks like a copper robot wearing a suit of obsidian armor.

Jax turns around to take in the entire room. “Wow.” He stops turning. “Wow wow. Sound different. Wow wow wow.”

“It’s okay, Jax,” says Ana. “Remember, I told you your voice might sound different in the outside world.” The information packet from SaruMech had warned about this; a metal and plastic chassis conducts sound in a way that avatars in Data Earth don’t.

Jax looks up to face Ana, and she marvels at the sight of him. She knows that he’s not really *in* the body — Jax’s code is still being run on the network, and this robot is just a fancy peripheral — but the illusion is perfect. And even after all their interaction in Data Earth, it’s thrilling to have Jax stand in front of her and look her in the eye.

“Hi Jax,” she says. “It’s me, Ana.”

“You wear different avatar,” Jax says.

“In the outside world, we call it a ‘body,’ not an ‘avatar.’ And people don’t switch their bodies here; we can only do that in Data Earth. Here we always wear the same body.”

Jax pauses to consider that. “You look this always?”

“Well, I can wear different clothes. But yes, this is the way I look.”

Jax walks over for a closer view, and Ana squats, elbows on knees, so they’re almost the same height. Jax peers at her hands, and then her forearms; she’s wearing short sleeves. He brings his head closer, and Ana can hear the faint whir of the robot’s camera eyes refocusing. “Little hairs on your arms,” he says.

She laughs; her avatar has arms as smooth as a baby’s. “Yes, there are.”

Jax brings up a hand and extends a thumb and forefinger to grab some of the hairs. He makes a couple of attempts, but like the pincers of a claw vending machine, his fingers keep slipping off. Then pinches her skin and pulls back.

“Ow. Jax, that hurts.”

“Sorry.” Jax scrutinizes Ana’s face. “Little little holes all over your face.”

Ana can feel the amusement of the others in the room. “Those are called ‘pores,’” she says, standing. “We can talk about my skin later. Right now why don’t you take a look around the room?”

Jax turns and slowly walks around the lobby, a miniature

astronaut exploring an alien world. He notices the window looking out onto the parking lot, and heads toward it.

Afternoon sunlight slants through the glass. Jax steps into the sunbeam, and abruptly backs out of it. “What that?”

“That’s the sun. It’s just like the one in Data Earth.”

Jax cautiously steps into the light again. “Not like. This sun bright bright bright.”

“That’s true.”

“Sun not need be bright bright bright.”

Ana laughs. “I suppose you’re right.”

Jax walks back over to her and looks at the fabric of her pants. Tentatively, she rubs the back of his head. The tactile sensors in the robot body are obviously working, because Jax leans into her hand; she can feel the weight of him, the dynamic resistance of his actuators. Then Jax hugs her around her thighs.

“Can I keep him?”she says to the others. ”He followed me home.” Everyone laughs.

“You say that now,” says Mahesh, “but wait until he flushes your hand towels down the toilet.”

“I know, I know,” says Ana. There were many reasons Blue Gamma targeted the virtual realm instead of the real one — lower cost, ease of social networking — but one was the risk of property damage; they couldn’t sell a pet that might tear down your actual Venetian blinds or make mayonnaise castles on your actual rug. “I just think it’s cool to see Jax this way.”

“You’re right, it is. For SaruMech’s sake, though, I hope the experience translates well onto video.” SaruMech Toys doesn’t plan to sell the robot bodies, but to rent them for a few hours at a time. Digients will be given use of bodies at a facility outside of Osaka and taken on a field trip into the real world, while the owners watch via cameras mounted on micro-zeppelins. Ana feels a sudden urge to go work for them; seeing Jax this way reminds her of how much she misses the physical part of working with animals, and why working with the digients through a video screen just isn’t the same.

Robyn asks Mahesh, “Do you want all the mascots to have a turn in the robot?”

“Yes, but only after they’ve passed the agility test. If we break this one, SaruMech isn’t going to give us another one for free.”

Now Jax is playing with her sneakers, tugging on the end of a shoelace. It’s not often that Ana wishes she were rich, but right now, feeling her shoelace grow taut from Jax’s pulling, that is exactly what she’s wishing. Because if she could afford it, she would buy one of these robots in a heartbeat.

#

Various employees take turns showing mascots the real world; Derek usually takes Marco or Polo. His first idea is to take them outside, around the office park where Blue Gamma is headquartered, and show them the strips of grass and shrubbery that divide the parking lot. He points out the crab-like robot that tends to the landscaping, product of an earlier venture in bringing digients into the real world. The robot is equipped with a stiletto-like trowel for pulling weeds, and its toil is purely instinct-driven; it's descended from generations of winners in an evolutionary gardening competition conducted in Data Earth hothouses. Derek's curious about how the mascots will react upon hearing the story of the weed-pulling robot, wondering if they'll identify with it as a fellow émigré from Data Earth, but they don't show the slightest interest.

Instead, it turns out that the mascots are fascinated by textures. Surfaces in Data Earth have a lot of visual detail, but no tactile qualities beyond a coefficient of friction; very few players use controllers that convey tactition, so most vendors don't bother implementing texture for their environmental surfaces. Now that the digients can feel surfaces in the real world, they find novelty in the simplest things. When Marco returns from his turn in the robot body, he can't stop talking about the carpets and furniture upholstery; when Polo is wearing the body, he spends all his time feeling the gritty nonskid treads in the building's stairwells. Not surprisingly, the sensor pads in the robot's fingers are the first components that need replacement. The next thing Marco notices is how Derek's mouth differs from his own. Digient mouths bear only a superficial resemblance to human mouths; although their lips move when they talk, the digients' speech generators aren't physics-based. Marco wants to learn about the mechanics of speech, and keeps asking to put his fingers in Derek's mouth when he talks. Polo is astonished to discover that food actually passes down Derek's throat when he swallows, rather than simply vanishing the way digient food does.

Derek had feared that the digients might be distressed to learn the boundaries of their physicality, but instead they just find it funny.

An unexpected benefit of seeing the digients in a robot body is that it provides a closer view of their faces than is common when watching them in Data Earth. As a result, the work that Derek has put in on the digients' facial expressions is easier to appreciate.

One day Ana comes to his cubicle and says excited,

"You are amazing!"

"Er…thanks?"

"I just saw Marco make the most hilarious expressions. You've got

to see them. May I?" Ana gestures at his keyboard, and Derek rolls his chair back from his desk so she can reach it. She opens a couple of video windows on his screen: one is a recording of the robot body's camera, showing the digient's point of view, while the other is a recording of what the helmet screen was displaying. Judging by the former, they were out in the parking lot again.

"He went on one of SaruMech's field trips last week," explains Ana, "and of course he loved it, so now he's bored with the office park."

On the screen, Marco says, *"Want go park we go field trip."*

"You can have just as much fun here." On the screen, Ana gestures for Marco to follow her.

The image swings back and forth as Marco shakes his head. *"Not same fun. Park more fun. Show you."*

"We can't go to that park. It's very far away; we would have to travel a long time to get there."

"Just open portal."

"Sorry Marco, I can't open portals here in the outside world."

"Now watch his face," says Ana.

"You try. Try hard please please." Marco forms his panda-bear face into a pleading expression; Derek hasn't seen it before, and it makes him burst out in laughter.

Ana laughs too, and says, "Keep watching."

On the screen she says, *"It doesn't matter how hard I try, Marco; the outside world doesn't have portals. Only Data Earth has portals."*

"Then we go Data Earth, open portal there."

"That would work for you if there's a body there for you to wear, but I can't wear a different body, I'd have to move this one, and that would take a long time."

Marco thinks about that, and Derek's delighted to see that the digient's face actually suggests his incredulity. *"Outside world dumb,"*the digient announces.

Derek and Ana burst out into laughter. She closes the windows and says, "You did some terrific work there."

"Thanks. And thanks for showing that to me; it made my day."

"Glad to do it."

It's nice to be reminded that his earlier work is bearing fruit, because most of Derek's recent assignments aren't nearly as interesting. The Origami and Faberge digients have begun to pop up in a wider variety of avatars, such as baby dragons, gryphons, and other mythological creatures, so Blue Gamma wants to offer similar avatars for the Neuroblast digients. The new avatars are straightforward modifications of the existing ones, requiring nothing new in terms of their facial expressions.

In fact, his newest assignment requires him to create an avatar with no facial expressions at all. A group of artificial-life hobbyists was impressed by the potential of the Neuroblast genome and, rather than wait for real intelligence to evolve on its own in the biomes, commissioned Blue Gamma to design an intelligent alien species for them. The developers engineered a personality taxon that was miles away from the breeds that Blue Gamma sells, and Derek's designing an avatar with three legs, a pair of tentacles instead of arms, and a prehensile tail. Some of the hobbyists want an even stranger body plan, as well as an environment with different physics, but he reminded them that they'll have to wear the avatars themselves when raising the digients, and controlling tentacles will be difficult enough.

The hobbyists have named their new species Xenotherians, and set up a private continent called Data Mars on which they intend to create an alien culture from scratch. Derek's curious about it but hasn't been able to visit, because the only language allowed in the presence of the digients is a custom dialect of the artificial language Lojban. He wonders how long the hobbyists will be able to stick with their project. Aside from the enormous barrier to entry, raising the Xenotherians won't offer pleasures like the one that he and Ana just got from watching Marco. The rewards will be purely intellectual, and over the long term, will that be enough?

Chapter Three

Over the course of the following year, the forecast for Blue Gamma's future changes from sunny to decidedly cloudy. Sales to new customers have slowed down, but worse than that, the revenue generated by the food-dispensing software has fallen: more and more of the existing customers are suspending their digients.

The problem is that as the Neuroblast digients leave infancy behind, they're growing too demanding. In breeding them Blue Gamma aimed for a combination of smart and obedient, but with the unpredictability inherent in any genome, even a digital one, it turns out the developers missed their target. Like an overly difficult game, the balance of challenge and reward that the digients provide is tilting beyond what most people consider fun, and so they suspend them. But unlike dog owners who bought a breed they were unprepared for, Blue Gamma's customers can't be blamed for not having done their homework; the company itself didn't know that the digients would evolve in this way.

Some volunteers have begun maintaining rescue shelters, accepting unwanted digients in hopes of matching them with new owners. These volunteers practice a variety of strategies; some keep the digients running without interruption, while others restore the digients from their last checkpoint every few days, to keep them from developing abandonment issues that might make it harder for them to get adopted. Neither strategy is enormously successful at attracting prospective owners. There is occasionally a person who wants to try a digient without having to raise one from infancy, but these adoptions never last for long, and the shelters essentially become digient warehouses.

Ana's not happy about this trend, but she's familiar with the realities of animal welfare: she knows you can't save them all. She'd prefer to shield Blue Gamma's mascots from what's happening, but the phenomenon is too widespread for that to be practical. Again and again she has taken them to a playground and one of the digients realizes that a regular playmate is absent.

Today's trip to a playground is different, and brings a pleasant surprise. Even before all the mascots are through the portal, Jax and Marco notice another digient wearing a robot avatar. They simultaneously exclaim "Tibo!" and run over to him.

Tibo is one of the oldest digients aside from the mascots, owned by a beta tester named Carlton. He suspended Tibo about a month ago; Ana's glad to see that it wasn't permanent. As the digients chatter, she walks her avatar over to Carlton's and talks with him; he

explains that he just needed a break, and now is feeling ready to give Tibo the attention he needs.

Later on, after she's brought the mascots back from the playground to Blue Gamma's island, Jax tells her about his conversation with Tibo. "Tell him about fun we do time he gone. Tell him about field trip zoo fun fun."

"Was he sad he missed it?"

"No he instead argue. He said field trip was mall not zoo. But that trip last month."

"That's because Tibo was suspended the whole time he's been gone," Ana explains, "so he thinks last month's trip was yesterday."

"I say that," says Jax, surprising her with his understanding, "but he not believe. He argue until Marco and Lolly too tell him. Then he sad."

"Well, I'm sure there'll be other trips to the zoo."

"Not because missed zoo. Sad missed month."

"Ah."

"I not want be suspended. Not want miss month."

Ana does her best to sound reassuring. "You don't have to worry about that, Jax."

"You not suspend me, right?"

"Right."

To her relief, Jax seems satisfied by this; he hasn't encountered the idea of extracting a promise, and she's embarrassingly glad that she didn't have to make him one. She takes comfort in the knowledge that if they suspend the mascots for any period of time, they'll almost certainly suspend all of them, so at least there won't be experiential discrepancies within the group. The same would be true if they ever roll the mascots back to a younger age. Restoring an early checkpoint is one of Blue Gamma's suggestions for customers who find their digients too demanding, and there's been talk that the company should do this with its own mascots to endorse the strategy.

Ana notices the time, and begins instantiating some games for the mascots to play on their own; it's time for her to train the digients in Blue Gamma's new product line. In the years since creating the Neuroblast genome, the developers have written more sophisticated tools for analyzing the interactions of its various genes, and they understand the genome's properties better. Recently they've created a taxon with less cognitive plasticity, resulting in digients that should stabilize more quickly and stay docile forever. The only way to know for certain is to let customers raise them for years and see what happens, but the developers' confidence is high. This is a significant departure from the company's original goal of digients that become ever more sophisticated, but drastic situations call for drastic

measures. Blue Gamma is counting on these new digients to stanch the loss of revenue, so Ana and the rest of the test team are intensively training them.

She has the mascots sufficiently well-trained that they wait for her permission before they start playing the games. “All right everyone, go ahead,” she says, and the digients all rush over to their favorites. “I’ll see you all later.”

“No,” says Jax. He stops and walks back to her avatar. “Don’t want play.”

“What? Sure you do.”

“No playing. Want job.”

Ana laughs. “What? Why do you want to get a job?”

“Get money.”

She realizes that Jax isn’t happy when he says this; his mood is glum. More seriously, she asks him, “What do you need money for?”

“Don’t need. Give you.”

“Why do you want to give me money?”

“You need,” he says, matter-of-factly.

“Did I say I need money? When?”

“Last week ask why you play with other digients instead me. You said people pay you play with them. If have money, can pay you. Then you play with me more.”

“Oh Jax.” She’s momentarily at a loss for words. “That’s very sweet of you.”

#

After another year has gone by, it becomes official: Blue Gamma is shutting down its operations. Not enough customers were willing to take a chance on the perpetually docile digients. Internally there were many proposals discussed, including a breed of digient that understands language but can’t speak, but it was too late. The customer base has stabilized to a small community of hardcore digient owners, and they don’t generate enough revenue to keep Blue Gamma afloat. The company will release a no-fee version of the food-dispensing software so those who want to can keep their digients running as long as they like, but otherwise, the customers are on their own.

Most of the other employees have been through company collapses before, so while they’re unhappy, for them this is just another episode of life in the software industry. For Ana, however, Blue Gamma’s folding reminds her of the closure of the zoo, which was one of the most heartbreaking experiences of her life. Her eyes

still tear up when she thinks about the last time she saw her apes, wishing that she could explain to them why they wouldn't see her again, hoping that they could adapt to their new homes. When she decided to retrain for the software industry, she was glad that she'd never have to face another such farewell in her new line of work. Now here she is, against all expectation, confronted with a strangely reminiscent situation.

Reminiscent, but not the same. Blue Gamma doesn't actually need to find new homes for its dozen mascots; it can just suspend them, with none of the implications that euthanasia would have. Ana herself has suspended thousands of digients during the breeding process, and they aren't dead or feeling abandoned. The only suffering created by suspending the mascots would be on the part of the trainers; Ana has spent time with the mascots every day for the last five years, and she doesn't want to say goodbye to them. Fortunately, there's an alternative: any employee can afford to keep a mascot as a pet in Data Earth, whereas keeping an ape in her apartment hadn't even been a possibility.

Given how easy it is, Ana's surprised that more of the employees don't want to adopt a mascot. She knows she can count on Derek to take one — he cares about the digients just as much as she does — but the trainers are unexpectedly reluctant. They're all fond of the digients, but most feel that keeping one as a pet now would be like doing their job after they've stopped being paid. Ana is sure that Robyn will take one, but Robyn preempts her with news of her own at lunch.

"We weren't going to tell anyone yet," Robyn confides, "but…I'm pregnant."

"Really? Congratulations!"

Robyn grins. "Thanks!" She releases a flood of pent-up information: the options that she and her partner Linda considered, the ova-fusion procedure they gambled on, their fabulous luck at having the first attempt succeed. Ana and Robyn discuss issues of job hunting and parental leave. Eventually they get back to the topic of adopting the mascots.

"Obviously you're going to have your hands full," says Ana, "but what do you think about adopting Lolly?" It would be fascinating to see Lolly's reaction to a pregnancy.

"No," says Robyn, shaking her head. "I'm past digients now."

"You're past them?"

"I'm ready for the real thing, you know what I mean?"

Carefully, Ana says, "I'm not sure that I do."

"People always say that we're evolved to want babies, and I used to think that was a bunch of crap, but not anymore." Robyn's facial

expression is one of transport; she's no longer speaking to Ana exactly. "Cats, dogs, digients, they're all just substitutes for what we're supposed to be caring for. Eventually you start to understand what a baby means, what it *really* means, and everything changes. And then you realize that all the feelings you had before weren't—" Robyn stops herself. "I mean, for me, it just put things in perspective."

Women who work with animals hear this all the time: that their love for animals must arise out of a sublimated child-rearing urge. Ana's tired of the stereotype. She likes children just fine, but they're not the standard against which all other accomplishments should be measured. Caring for animals is worthwhile in and of itself, a vocation that need offer no apologies. She wouldn't have said the same about digients when she started at Blue Gamma, but now she realizes it might be true for them, too.

Chapter Four

The year following Blue Gamma's closure involves many changes for Derek. He gets a job at the firm that employs his wife Wendy, animating virtual actors for television. He's fortunate to work on a series with good writing, but no matter how quick-witted and nonchalant the dialogue sounds, every word of it, every nuance and intonation, is painstakingly choreographed. During the animation process he hears the lines delivered a hundred times, and the final performance seems glossy and sterile in its perfection.

By contrast, life with Marco and Polo is a never ending stream of surprises. He adopted both of them because they didn't want to be separated, and while he can't spend as much time with them as when he worked for Blue Gamma, owning a digient now is actually more interesting than it's ever been before. The customers who kept their digients running formed a Neuroblast user group to keep in touch, and while it's a smaller community than before, the members are more active and engaged, and their efforts are bearing fruit.

Right now it's the weekend, and Derek is driving to the park; in the passenger seat is Marco, wearing a robotic body. He's standing upright on the seat — restrained by the seat belt — so he can see out the window; he's looking for anything that he's only seen before in videos, things that aren't found in Data Earth.

"Firi hidrint," says Marco, pointing.

"Fire hydrant."

"Fire hydrant."

"That's right."

The body Marco's wearing is the one that Blue Gamma owned. Group field trips came to an end because SaruMech Toys closed shortly after Blue Gamma did, so Ana — who got a job testing software used in carbon-sequestration stations — bought the robot body at a discount for Jax to use. She let Derek borrow the body last week so Marco and Polo could play in it, and now he's returning it. She's going to spend the day in the park, letting other owners' digients have a turn in the body.

"I make fire hydrant next craft time," says Marco. "Use cylinder, use cone, use cylinder."

"That sounds like a good idea," says Derek.

Marco's talking about the craft sessions that the digients now have every day. These began a few months ago, after an owner wrote software that allowed a few of Data Earth's onscreen editing tools to be operated from within the Data Earth environment itself. By manipulating a console of knobs and sliders, a digient can now

instantiate various solid shapes, change their color, and combine and edit them in a dozen different ways. The digients are in heaven; to them it seems as if they've been granted magical powers, and given the way the editing tools circumvent Data Earth's physics simulation, in a sense they have. Every day after work when Derek logs into Data Earth, Marco and Polo show him the craft projects they've made.

"Then can show Polo how — Park! Park already?"

"No, we're not there yet."

"Sign says 'Burgers and Parks.'" Marco points out a sign that they're driving past.

"It says 'Burgers and Shakes.' Shakes, not parks. We've still got a little way to go."

"Shakes," Marco says, watching the sign recede in the distance. Another new activity for the digients has been reading lessons.

Marco or Polo never paid much attention to text before — there isn't a lot of it in Data Earth aside from onscreen annotations, which aren't visible to digients — but one owner successfully taught his digient to recognize commands written on flashcards, prompting a number of other owners to give it a try. Generally speaking, the Neuroblast digients recognize words reasonably well, but have trouble associating individual letters with sounds. It's a variety of dyslexia that appears to be specific to the Neuroblast genome; according to other user groups, Origami digients learn letters readily, while Faberge digients remain frustratingly illiterate no matter what instruction method is used.

Marco and Polo take a reading class with Jax and a few others, and they seem to enjoy it well enough. None of the digients were raised on bedtime stories, so text doesn't fascinate them the way it does human children, but their general curiosity — along with the praise of their owners — motivate them to explore the uses that text can be put to. Derek finds it exciting, and laments the fact that Blue Gamma didn't stay in business long enough to see these things come to pass.

They arrive at the park; Ana sees them and walks over as Derek parks the car. Marco gives Ana a hug as soon as Derek lets him out of the car.

"Hi Ana."

"Hi Marco," replies Ana; she rubs the back of the robot's head. "You're still in the body? You had a whole week. Wasn't that enough?"

"Wanted ride in car."

"Did you want to play in the park for a bit?"

"No, we go now. Wendy not want us stay. Bye Ana." By now Derek has gotten the charging platform for the robot out of the

backseat. Marco steps on to the charging platform — they've trained the digients to return to it whenever they return to Data Earth — and the robot's helmet goes dark.

Ana uses her handheld to get the first digient ready to enter the robot. "So you have to go, too?" she asks Derek.

"No, I don't have to be anywhere."

"So what did Marco mean?"

"Well…"

"Let me guess: Wendy thinks you spend too much time with digients, right?"

"Right," says Derek. Wendy was also uncomfortable with the amount of time he's been spending with Ana, but there's no point in mentioning that. He assured Wendy that he doesn't think of Ana that way, that they're just friends who share an interest in digients.

The robot's helmet lights up to display a jaguar-cub face; Derek recognizes him as Zaff, who's owned by one of the beta testers. "Hi Ana hi Derek," says Zaff, and immediately runs toward a nearby tree. Derek and Ana follow.

"So seeing them in the robot body didn't win her over?" asks Ana.

Derek stops Zaff from picking up some dog turds. To Ana, he says, "Nope. She still doesn't understand why I don't suspend them whenever it's convenient."

"It's hard to find someone who understands," Ana says. "It was the same when I worked at the zoo; every guy I dated felt like he was coming in second. And now when I tell a guy that I'm paying for reading lessons for my digient, he looks at me like I'm crazy."

"That's been an issue for Wendy, too."

They watch as Zaff sorts through the leaf litter, extracts a leaf decayed to near transparency, and holds it up to his face to look through it, a mask of vegetable lace. "Although I guess I shouldn't really blame them," says Ana. "It took me a while to understand the appeal myself."

"Not me," says Derek. "I thought digients were amazing right away."

"That's true," agrees Ana. "You're a rare one."

Derek watches her with Zaff, admires her patience in guiding him. The last time he felt so much in common with a woman was when he met Wendy, who shared his excitement at bringing characters to life through animation. If he weren't already married, he might ask Ana out, but there's no point in speculating about that now. The most they can be is friends, and that's good enough.

#

It's a year later, and Ana is spending the evening at her apartment. On her computer she has a window open to Data Earth, where her avatar is at a playground, supervising a group play-date that Jax has with a handful of other digients. The number of digients continues to shrink — Tibo, for example, hasn't been around in months — but Jax's regular group has merged with another one recently, so he still has the opportunity to make new friends. A few of the digients are up in the climbing equipment, others play with toys on the ground, while a couple watch a virtual television.

In another window, Ana browses through the user-group discussion forums. The topic *du jour* is the latest action by the Information Freedom Front, an organization that lobbies for the end of privately owned data. Last week they publicized techniques for cracking many of Data Earth's access-control mechanisms, and in recent days people have been seeing rare and expensive items from their game inventories being handed out like flyers on a downtown street corner. Ana hasn't been to a game continent in Data Earth since the problem began.

In the playground, Jax and Marco have decided to play a new game. They both get down on all fours and begin crawling around. Jax waves to get her attention, and she walks her avatar over to him. "Ana," he says, "you know ants talk each other?" They've been watching nature videos on the television.

"Yes, I've heard that," she says. "You know we know what they saying?"

"You do?"

"We talk ant language. Like this: imp fimp deemul weetul."

Marco replies, "Beedul jeedul lomp womp."

"And what does that mean?"

"Not tell you. Only we know."

"We and ants," adds Marco.

And then Jax and Marco both laugh, *mo mo mo,* and Ana smiles. The digients run off to play something else, and she goes back to browsing the forums.

> **FROM: Helen Costas**
>
> Do you think we need to worry about our digients being copied?

> **FROM: Stuart Gust**
>
> Who would bother? If there were a big demand for digients, Blue Gamma wouldn't have gone out of business. Remember what happened with the shelters? You literally couldn't give a digient away. And it's not as if they've gotten any more popular since then.

In the playground, Jax exclaims, “I win!” He’s been playing some vaguely defined game with Marco. He rocks side to side in triumph.

“Okay,” says Marco, “your turn.” He sorts through the toys around him until he finds a kazoo and then hands it to Jax.

Jax puts one end of the kazoo in his mouth. He gets on his knees and uses the kazoo to rhythmically poke at Marco’s midsection, around where his navel would be if he had one.

Ana asks, “Jax, what are you doing?”

Jax takes the kazoo from his mouth. “Make Marco blowjob.”

“What? Where did you see a blowjob?”

“On TV yesterday.”

She looks at the television; right now it’s showing a child’s cartoon. The television is supposed to draw its content from a children’s video repository; someone is probably inserting adult material using the IFF hack. She decides not to make a big deal of it to the digients. “Okay,” she says, and Jax and Marco resume their mime. She posts a note about the video tampering to the forums, and continues reading.

A few minutes later, Ana hears an unfamiliar chittering sound, and sees that Jax has gone to watch television; all of the digients are watching it. She moves her avatar so she can see what’s drawn their attention.

On the virtual television, a person wearing a clown avatar is holding down a digient wearing a puppy avatar, and hitting the digient’s legs repeatedly with a hammer. The digient’s legs can’t break because its avatar wasn’t designed to account for that, and it probably can’t scream for similar reasons, but the digient must be in agony, and the chittering sounds are the only way it can express that.

Ana turns the virtual television off.

“What happen?” asks Jax, and several of the other digients repeat the question, but she doesn’t answer. Instead she opens a window on her physical screen to read the description accompanying the video that was playing. It’s not an animation, but a recording of a griefer using the IFF hack to disable the pain circuit-breakers on a digient’s body. Even worse, the digient isn’t an anonymous new instantiation, but someone’s beloved pet, illicitly copied using the IFF hack. The digient’s name is Nyyti, and Ana realizes that he’s a classmate in Jax’s reading lessons.

Whoever copied Nyyti could have a copy of Jax, too. Or he could be making a copy of Jax right now. Given Data Earth’s distributed architecture, Jax is vulnerable if the griefer is anywhere on the same continent as the playground.

Jax is still asking about what they saw on the television. Ana opens a window listing all the Data Earth processes running under her

account, finds the one that represents Jax, and suspends it. In the playground, Jax freezes in midsentence and then vanishes.

"What happen Jax?" asks Marco.

Ana opens another window for Derek's processes — they granted each other full privileges for their accounts — and suspends Marco and Polo. She doesn't have full privileges for the other digients, though, and she's not sure what to do next. She can see that they're agitated and confused. They don't have the fight-or-flight response that animals have, nor do they have any reactions triggered by smelling pheromones or hearing distress calls, but they do have an analog of mirror neurons. It helps them learn and socialize, but it also means they're distressed by what they saw on the television.

Everyone who brought their digient to the playdate granted Ana permission to make the digients take a nap, but their processes would still be running even if they were asleep, meaning they'd still be at risk of being copied. She decides to move the digients to a small island, away from the major continents, in hopes that there's less chance that a griefer will be scanning processes there.

"Okay everybody," she announces, "we're going to the zoo." She opens a portal to the visitor's center of the Pangaea archipelago and ushers the digients through it. The visitor's center appears to be empty, but she's not taking any chances. She forces the digients to sleep and then sends messages to all their owners, telling them where they can pick up their digients. She keeps her avatar with them while she goes on the forums to warn everyone else.

Over the next hour the other owners arrive to pick up their digients, while Ana watches the discussion on the forums bloom like algae. There's outrage and threats of lawsuits against various parties. Some gamers take the position that digient owners' complaints should take a backseat to their own because digients have no monetary value, igniting a flame war. Ana ignores most of it, looking for information about the response from Daesan Digital, the company that runs the Data Earth platform. Eventually there's solid news:

> **FROM: Enrique Beltran**
>
> Daesan has an upgrade to Data Earth's security architecture that they say will fix the breach. It was going to be part of next year's update, but they're bumping it up because of what's been happening. They can't give us a schedule for when it'll be done. Until it is, everyone better keep your digients suspended.

> **FROM: Maria Zheng**
>
> There's another option. Lisma Gunawan is setting up a private island, and she's only going to allow approved code

to run on it. You won't be able to use anything you've bought recently, but Neuroblast digients will run fine. Contact her if you want to be put on the visitor list.

Ana sends a request to Lisma, and gets an automated reply promising news when the island is ready. Ana's not set up to run a local instance of the Data Earth environment herself, but she does have another option. She spends an hour configuring her system to run a completely local instance of the Neuroblast engine; without a Data Earth portal, she has to load Jax's saved state manually, but eventually she's able to get Jax running with the robot body.

"—turn off television?" He stops, realizing his surroundings have changed. "What happen?"

"It's okay, Jax." He sees the body he's wearing. "I in outside world." He looks at her.

"You suspend me?"

"Yes, I'm sorry. I know I said I wouldn't, but I had to."

Plaintively, he asks, "Why?"

Ana's embarrassed by how hard she's hugging the robot body. "I'm trying to keep you safe."

#

A month later, Data Earth gets its security upgrade. The IFF disclaims any responsibility for what griefers do with the information they published, saying that every freedom has the potential to be abused, but they shift their attention to other projects. For a while, at least, the public continents in Data Earth are safe for digients again, but the damage has been done. There's no way to track down copies that are being run privately, and even if no one releases videos of digient torture anymore, many Neuroblast owners can't bear the thought that such things are going on; they suspend their digients permanently and leave the user group.

At the same time, other people are excited by the availability of copied digients, particularly of digients who've been taught to read. Members of an AI research institute have wondered whether digients could form their own culture if left in a hothouse, but they never had access to digients who could read, and they weren't interested in raising any themselves. Now the researchers assemble copies of as many text-literate digients as they can, mostly Origami digients since they have the best reading skills, but they mix in a few Neuroblast ones as well. They put them on private islands furnished with text and software libraries, and started running the islands at hothouse speeds. The discussion forums teem with speculation about cities in a bottle, microcosms on a tabletop.

Derek thinks the idea is ridiculous — a bunch of abandoned

children aren't going to become autodidacts no matter how many books they're left with — so he's not surprised to read about the results: every test population eventually goes feral. The digients don't have enough aggression in them to descend into "Lord of the Flies"-style savagery; they simply divide into loose, non-hierarchical troops. Initially, each troop's daily routines are held together by force of habit — they read and use eduware when it's time for school, they go to the playgrounds to play — but without reinforcement these rituals unravel like cheap twine. Every object becomes a toy, every space a playground, and gradually the digients lose what skills they had. They develop a kind of culture of their own, perhaps what wild digient troops would demonstrate if they'd evolved on their own in the biomes.

As interesting as that is, it's a far cry from the nascent civilization that the researchers were seeking, so they try redesigning the islands. They try to increase the variety of the test populations, asking owners of educated digients to donate copies; to Derek's surprise, they actually receive a few from owners who have grown tired of paying for reading lessons and are satisfied that the feral digients aren't suffering. The researchers devise various incentives — all automated, so no real-time interaction is required — to keep the digients motivated. They impose hardships so that indolence has a cost. While a few of the revised test populations avoid going feral, none ever begin the climb toward technological sophistication.

The researchers conclude that there's something missing in the Origami genome, but as far as Derek's concerned, the fault lies with them. They're blind to a simple truth: complex minds can't develop on their own. If they could, feral children would be like any other. And minds don't grow the way weeds do, flourishing under indifferent attention; otherwise all children in orphanages would thrive. For a mind to even approach its full potential, it needs cultivation by other minds. That cultivation is what he's trying to provide for Marco and Polo.

Marco and Polo occasionally get into arguments, but they don't stay angry for very long. A few days ago, however, the two of them got into a fight over whether it was fair that Marco had been instantiated earlier than Polo, and for some reason it escalated. The two digients have hardly spoken to each other since, so Derek's relieved when they approach him as a pair.

"It's nice to see you two together again. Have you guys made up?"

"No!" says Polo. "Still angry."

"I'm sorry to hear that."

"Both us want your help," says Marco.

“Okay, what can I do?”

“Want you roll back us last week, before big fight.”

“What?” This is the first time he’s ever heard of a digient requesting to be restored from a checkpoint. “Why would you want that?”

“I want not remember big fight,” says Marco. “I want be happy, not angry,” says Polo.

“You want us be happy, right?”

Derek opts not to get into a discussion about the difference between their current instantiations and instantiations restored from a checkpoint. “Of course I do, but I can’t just roll you back every time you have a fight. Just wait a while, and you won’t be so angry.”

“Have waited, and still angry,” says Polo. “Fight big big. Want it never happen.” As soothingly as he can, Derek says, “Well, it did happen, and you’re going to have to deal with it.”

“No!” shouts Polo. “I angry angry! Want you fix it!”

“Why you want us stay angry forever?” demands Marco.

“I don’t want you to stay angry forever, I want you to forgive each other. But if you can’t, then we’ll all have to live with that, me included.”

“Now angry at you too!” says Polo.

The digients storm off in different directions, and he wonders if he’s made the right decision. It hasn’t always been easy raising Marco and Polo, but he’s never rolled them back to an earlier checkpoint. This strategy has worked well enough so far, but he can’t be certain it will keep working.

There are no guidebooks on raising digients, and techniques intended for pets or children fail as often as they succeed. The digients inhabit simple bodies, so their voyage to maturity is free from the riptides and sudden squalls driven by an organic body’s hormones, but this doesn’t mean that they don’t experience moods or that their personalities never change; their minds are continuously edging into new regions of the phase space defined by the Neuroblast genome. Indeed, it’s possible that the digients will never reach “maturity”; the idea of a developmental plateau is based on a biological model that doesn’t necessarily apply. It’s possible their personalities will evolve at the same rate for as long as the digients are kept running. Only time will tell.

Derek wants to talk about what just happened with Marco and Polo; unfortunately, the person he wants to talk to isn’t his wife. Wendy understands the possibilities for the digients’ growth, and recognizes that Marco and Polo will become more and more capable the longer they’re cared for; she simply can’t generate any enthusiasm about that prospect. Resentful of the time and attention he devotes to

the digients, she would consider their request to be rolled back the perfect opportunity to suspend them for an indefinite period.

The person he wants to talk to is, of course, Ana. What once seemed a groundless fear of Wendy's has come true; he has definitely developed feelings for her beyond friendship. It's not the cause of the problems he's having with Wendy; if anything, it's a result. The time he spends with Ana is a relief, a chance for him to enjoy the digients' company unapologetically. When he's angry he thinks it's Wendy's fault for driving him away, but when he's calm he realizes that's unfair.

The important thing is that he hasn't acted on his feelings for Ana, and he doesn't plan to. What he needs to focus on is reaching an accord with Wendy regarding the digients; if he can do that, the temptation that Ana poses should pass. Until then, he ought to reduce the amount of time he spends with Ana. It's not going to be easy: given how small the digient-owner community is, interaction with Ana is inevitable, and he can't let Marco and Polo suffer because of this. He's not sure what to do, but for now, he refrains from calling Ana for advice and posts a question to the forum instead.

Chapter Five

Another year passes. Currents within the mantle of the marketplace change, and virtual worlds undergo tectonic shifts in response: a new platform called Real Space, implemented using the latest distributed-processing architecture, becomes the hot-spot of digital terrain formation. Meanwhile Anywhere and Next Dimension stop expanding at their edges, cooling into a stable configuration. Data Earth has long been a fixture in the universe of virtual worlds, resistant to growth spurts or sharp downturns, but now its topography begins to erode; one by one, its virtual land masses disappear like real islands, vanishing beneath a rising tide of consumer indifference.

Meanwhile, the failure of the hothouse experiments to produce miniature civilizations has caused general interest in digital lifeforms to dwindle. Occasionally curious new fauna are observed in the biomes, a species demonstrating an exotic body plan or a novel reproductive strategy, but it's generally agreed that the biomes aren't run at a high enough resolution for real intelligence to evolve there. The companies that make the Origami and Faberge genomes go into decline. Many technology pundits declare digients to be a dead end, proof that embodied AI is useless for anything beyond entertainment, until the introduction of a new genomic engine called Sophonce.

Sophonce's designers wanted digients that could be taught via software instead of needing interaction with humans; toward that end, they've created an engine that favors asocial behavior and obsessive personalities. The vast majority of the digients generated with the engine are discarded for their psychological malformations, but a tiny fraction prove capable of learning with minimal supervision: give them the right tutoring software and they'll happily study for weeks of subjective time, meaning that they can be run at hothouse speeds without going feral. Some hobbyists demonstrate Sophonce digients that outperform Neuroblast, Origami, and Faberge digients on math tests, despite having been trained with far less real-time interaction. There's speculation that, if their energies can be directed in a practical direction, Sophonce digients could become useful workers within a matter of months. The problem is that they're so charmless that few people want to engage in even the limited amounts of interaction that the digients require.

#

Ana has brought Jax along with her to Siege of Heaven, the first

new game continent to appear in Data Earth in a year. She shows him around the Argent Plaza, where players congregate and socialize in between missions; it's a massive courtyard of white marble, lapis lazuli, and gold filigree located on top of a cumulonimbus cloud. Ana has to wear her game avatar, a kestrel-cherub, but Jax keeps his traditional copper robot avatar.

As they're strolling amongst the other gamers, Ana sees the onscreen annotation for a digient. His avatar is a hydrocephalic dwarf, the standard avatar for a Drayta: a Sophonce digient who's skilled at solving the logic puzzles found on the gaming continents. The original Drayta's owner trained him using a puzzle generator pirated from the Five Dynasties continent on the Real Space platform, and then released copies to the public domain. Now so many gameplayers take a Drayta with them on their missions that game companies are considering major redesigns.

Ana directs Jax's attention to the other digient. "See the guy over there? He's a Drayta."

"Really?" Jax has heard about Draytas, but this is the first one he's met. He walks over to the dwarf. "Hi," he says. "I'm Jax."

"Wanna solve puzzles," says Drayta.

"What kind puzzles you like?"

"Wanna solve puzzles." Drayta is getting anxious; he runs around the waiting area.

"Wanna solve *puzzles.*"

A nearby gamer wearing a osprey-seraph avatar pauses in his conversation to point a finger at Drayta; the digient freezes in midstep, shrinks to a icon, and snaps into one of the gamer's belt compartments as if pulled by an elastic.

"Drayta weird," says Jax.

"Yes he was, wasn't he?"

"All Draytas like that?"

"I think so."

The seraph walks over to Ana. "What kind of digient have you got? Haven't seen his sort before."

"His name's Jax. He runs on the Neuroblast genome."

"Don't know that one. Is it new?"

One of the seraph's teammates, wearing a nephilim avatar, comes by. "Nah, it's old, last generation."

The seraph nods. "Is he good at puzzles?"

"Not really," says Ana.

"So what does he do?"

"I like singing," volunteers Jax.

"Really? Let's have a song, then."

Jax doesn't need further encouragement; he launches into one of

his favorites, “Mack the Knife” from *Threepenny Opera*. He knows all the words, but the tune he sings is at best a rough approximation of the actual melody. At the same time he performs an accompanying dance that he choreographed himself, mostly a series of poses and hand gestures borrowed from an Indonesian hip-hop video he likes.

The other gamers laugh all through his performance. Jax finishes with a curtsy, and they applaud. “That’s brilliant,” says the seraph.

Ana says to Jax, “That means he likes it. Say thanks.”

“Thanks.”

To Ana, the seraph says, “Not going to be much help in the labyrinths, is he?”

“He keeps us entertained,” she says.

“I’ll bet he does. Send me a message if he ever learns to solve puzzles, I’ll buy a copy.” He sees that his entire team has assembled.

“Well, off to our next mission. Good luck on yours.”

“Good luck,” says Jax. He waves as the seraph and his teammates take flight and dive in formation toward a distant valley. Ana’s reminded of that encounter a few days later, when she’s reading a discussion on the user-group forums:

> **FROM: Stuart Gust**
>
> Last night I played SoH with some people who take a Drayta on their missions, and while he wasn’t much fun, he was definitely useful to have around. It made me wonder if it has to be one or the other. Those Sophonce digients aren’t any better than ours. Couldn’t our digients be both fun *and* useful?

> **FROM: Maria Zheng**
>
> Are you hoping to sell copies of yours? You think you can raise a better Andro?

Maria’s referring to a Sophonce digient named Andro, trained by his owner Bryce Talbot to act as his personal assistant. Talbot demonstrated Andro to VirlFriday, maker of appointment-management software, and got the company’s executives interested. The deal fell through after the executives got demonstration copies; what Talbot hadn’t realized was that Andro was, in his own way, as obsessive as Drayta. Like a dog forever loyal to its first owner, Andro wouldn’t work for anyone else unless Talbot was there to give orders.

VirlFriday tried installing a sensory input filter, so each new Andro instantiation perceived his new owner’s avatar and voice as Talbot’s, but the disguise never worked for more than a couple of hours. Before long all the executives had to shut down their forlorn Andros, who kept looking for the original Talbot.

As a result, Talbot wasn't able to sell the rights to Andro for anywhere near what he'd hoped. Instead, VirlFriday bought the rights to Andro's specific genome and a complete archive of his checkpoints, and they've hired Talbot to work for them. He's part of a team that's restoring earlier checkpoints of Andro and retraining them, attempting to create a version that has the same personal-assistant skills and is also willing to accept a new owner.

> **FROM: Stuart Gust**
>
> No, I don't mean selling copies. I'm just thinking about Zaff doing work the way dogs guide the blind or sniff out drugs. My goal isn't to make money, but if there's something the digients can do that people are willing to pay for, it would prove to all the skeptics out there that digients aren't just for entertainment.

Ana posts a reply:

> **FROM: Ana Alvarado**
>
> I just want to make sure we're clear about our motivations. It'd be terrific if our digients learned practical skills, but we shouldn't think of them as failures if they don't. Maybe Jax can make money, but Jax isn't *for* making money. He's not like the Draytas, or the weedbots. Whatever puzzles he might solve or work he might do, those aren't the reason I'm raising him.

> **FROM: Stuart Gust**
>
> Yes, I agree with that completely. All I meant was that our digients might have untapped skills. If there's some kind of job they'd be good at, wouldn't it be cool for them to do that job?

> **FROM: Maria Zheng**
>
> But what can they do? Dogs were bred to be good at specific things, and Sophonce digients are so single minded that they only want to do one thing, whether they're good at it or not. Neither is true for Neuroblast digients.

> **FROM: Stuart Gust**
>
> We could expose them to lots of different things and see what they have an aptitude for. Give them a liberal arts education instead of vocational training. (I'm only half kidding.)

FROM: Ana Alvarado

That's actually not as silly as it might sound. Bonobos have learned to do everything from making stone cutting tools to playing computer games when they were given the chance. Our digients might be good at things that it hasn't occurred to us to train them for.

FROM: Maria Zheng

Just what are we talking about? We've already taught them to read. Are we going to give them lessons in science and history? Are we going to teach them critical thinking skills?

FROM: Ana Alvarado

I really don't know. But I think that if we do this, it's important to have an open mind and not be skeptical. Low expectations are a self-fulfilling prophecy. If we aim high, we'll get better results.

Most of the user-group members are content with their digients' current education — an improvised mixture of home-schooling, group tutoring, and eduware — but there are some who are excited by the idea of going further. This latter group begins a discussion with their digients' tutors about expanding the curriculum. Over the course of months, various owners read up on pedagogical theory and try to determine how the digients' learning style differs from those of chimps or human children, and how to design lesson plans that best accommodate it. Most of the time the owners are receptive to all suggestions, until the question arises of whether the digients might make faster progress if their tutors assigned them homework.

Ana prefers that they find activities that develop skills but which the digients enjoy enough to do on their own. Other owners argue that the tutors ought to give the digients actual assignments to be completed. She's surprised to read a forum post from Derek in which he supports the idea. She asks him about it the next time they talk.

"Why would you want to make them do homework?"

"What's wrong with that?" says Derek. "Is this because you once had a mean teacher when you were a kid?"

"Very funny. Come on, I'm serious."

"Okay, seriously: what's so bad about homework?"

She hardly knows where to begin. "It's one thing for Jax to have ways to keep himself entertained outside of class," she says. "But to give him assignments and tell him he has to finish them even if he doesn't enjoy it? To make him feel bad if he doesn't do it? That goes against every principle of animal training."

“A long time ago, you were the one who told me that digients weren’t like animals.”

“Yes, I did say that,” she allows. “But they’re not tools either. And I know you know that, but what you’re talking about, it sounds like you’re preparing them to do work that they wouldn’t want to do.”

He shakes his head. “It’s not about making them work, it’s about getting them to learn some responsibility. And they might be strong enough to take feeling bad once in a while; the only way to know is to try.”

“Why take the chance of making them feel bad at all?”

“It was something I thought of when I was talking with my sister,” he says. Derek’s sister teaches children born with Down syndrome. “She mentioned that some parents don’t want to push their kids too much, because they’re afraid of exposing them to the possibility of failure. The parents mean well, but they’re keeping their kids from reaching their full potential when they coddle them.”

It takes her a little time to get used to this idea. Ana’s accustomed to thinking of the digients as supremely gifted apes, and while in the past people have compared apes to children with special needs, it was always more of a metaphor. To view the digients more literally as special-needs children requires a shift in perspective. “How much responsibility do you think the digients can handle?”

Derek spreads his hands. “I don’t know. In a way it’s like Down Syndrome; it affects every person differently, so whenever my sister works with a new kid, she has to play it by ear. We have even less to go on, because no one’s ever raised digients for this long before. If it turns out that the only thing we’re accomplishing with homework assignments is making them feel bad, then of course we’ll stop. But I don’t want Marco and Polo’s potential to be wasted because I was afraid of pushing them a little.”

She sees that Derek has a very different idea of high expectations than she has. More than that, she realizes that his is actually the better one. “You’re right,” she says, after a pause. “We should see if they can do homework.”

#

It’s a year later, and Derek is finishing up some work before he meets Ana for lunch on a Saturday. For the last couple of hours he’s been testing an avatar modification that would change the proportions of the digients’ bodies and faces to make them look more mature. Among those owners who have opted to further their digients’ education, more and more are commenting on the incongruity

between the digients' eternally cute avatars and their increasing competence. This add-on is intended to correct that, and make it easier for the owners' to think of the digients as more capable.

Before leaving, he checks his messages, and is puzzled to see a couple from strangers accusing him of running some kind of scam. The messages seem legitimate, so he reads them more closely. The senders are complaining about a digient approaching them in Data Earth and asking for money.

Derek realizes what must have happened. He recently began giving Marco and Polo an allowance, which they usually spend on game subscriptions or virtual toys; they've asked for more, but he's held the line. They must have decided to ask people in Data Earth at random for money and been rebuffed, but since the digients are running under Derek's Data Earth account, people assumed that he had trained them to beg for money.

He'll send complete apologies to these people later on, but right now he tells Marco and Polo to enter their robot bodies immediately. Fabrication technology has reached the point where he was able to afford two robot bodies of his own, customized to complement Marco and Polo's avatars. A minute later, their panda-bear faces appear in the robots' helmets, and Derek reprimands them for asking strangers for money."I thought you would know better," he says.

Polo is apologetic. "Yes, know better," he says.

"So why did you do it?"

"My idea, not Polo's," says Marco. "Knew they wouldn't give money. Knew they'd message you."

Derek's astonished. "You were trying to get people angry at me?"

"This happen because we on your account," says Marco. "Not happen if we have own accounts, like Voyl."

Now he understands. The digients have been hearing about a Sophonce digient named Voyl. Voyl's owner — a lawyer named Gerald Hecht — filed papers to create the Voyl Corporation, and Voyl now runs under a separate Data Earth account registered to that corporation. Voyl pays taxes and is able to own property, enter into contracts, file lawsuits and be sued; in many respects he is a legal person, albeit one for whom Hecht technically serves as director.

The idea has been around for a while. Artificial-life hobbyists all agree on the impossibility of digients ever getting legal protection as a class, citing dogs as an example: human compassion for dogs is both deep and wide, but the euthanasia of dogs in pet shelters amounts to an ongoing canine holocaust, and if the courts haven't put a stop to that, they certainly aren't going to grant protection to entities that lack a heartbeat. Given this, some owners believe the most they can hope for is legal protection on an individual basis: by filing articles of

incorporation on a specific digient, an owner can take advantage of a substantial body of case law that establishes rights for nonhuman entities. Hecht is the first one to have actually done it.

"So you were trying to make a point," says Derek.

"People say being corporation great," says Marco. "Can do whatever want."

A number of human adolescents have complained that Voyl has more rights than they do; obviously the digients have seen their comments. "Well, you're *not* incorporated, and you definitely *cannot* do anything you want."

"We sorry," says Marco, suddenly appreciating the trouble he's in. "Just want be corporations."

"I told you before: you're not old enough."

"We older Voyl," says Polo.

"Me especially," says Marco.

"Voyl's not old enough for it, either. His owner made a mistake."

"So you not let us be corporations ever?"

Derek gives them a stern look. "Maybe one day, when you're much older; we'll see. But if you two try a stunt like this again, there are going to be serious repercussions. You understand?"

The digients are glum. "Yes," says Marco.

"Yes," says Polo.

"Okay. I've got to go; we'll talk about this more later." Derek scowls at them. "You two get back into Data Earth now."

As he drives to the restaurant, Derek again thinks about what Marco is asking for. A lot of people are skeptical about the idea of digients becoming corporations; they view Hecht's actions as nothing more than a stunt, an impression Hecht only reinforces by issuing press releases about his plans for Voyl. Right now Hecht essentially runs the Voyl Corporation, but he's training Voyl in business law and insists that someday Voyl will make all the decisions himself; the role of director, whether filled by Hecht or by someone else, will be nothing but a formality. In the meantime, Hecht invites people to put Voyl's status as a legal person to the test. Hecht has the resources for a court battle, and he's itching for a fight. So far no one has taken him up on it, but Derek hopes that someone will; he wants the precedents to be well established before he'll consider incorporating Marco and Polo.

The question of whether Marco or Polo would ever be intellectually capable of becoming corporations is another question, and to Derek's mind a more difficult one to answer. The Neuroblast digients have shown that they can do homework on their own, and he's confident that their attention spans for independent tasks will increase steadily over time, but even if they become able to do

sizeable projects without supervision, that's still a far cry from being able to make responsible decisions about one's future. And he's not even sure if that level of independence is something he should encourage Marco and Polo to have as a goal. Turning Marco and Polo into corporations opens the door to keeping them running after Derek himself has passed away, which is a worrisome prospect: for Down Syndrome individuals, there are organizations that provide assistance to people living on their own, but similar support services don't exist for incorporated digients. It might be better to ensure that Marco and Polo are suspended in the event that Derek can't take care of them.

Whatever he decides to do, he'll have to do it without Wendy; they've decided to file for divorce. The reasons are complicated, of course, but one thing is clear: raising a pair of digients is not what Wendy wants from life, and if Derek wants a partner in this endeavor, he'll have to find someone else. Their marriage counselor has explained that the problem isn't the digients *per se*, it's the fact that Derek and Wendy can't find a way to accommodate their having different interests. Derek knows the counselor's right, but surely having common interests would have helped.

He doesn't want to get ahead of himself, but he can't stop thinking that getting divorced offers him an opportunity to be more than just friends with Ana. Surely she's considered the possibility too; after all the time they've known each other, how could she not have? The two of them would make a great team, working together for what's best for their digients.

Not that he plans to declare his feelings at lunch; it's too soon for that, and he knows Ana is seeing someone right now, a guy named Kyle. But their relationship is fast approaching the six-month mark, which is usually when the guy realizes that Jax isn't just a hobby, but the major priority in her life; it probably won't be long before the breakup follows. Derek figures that in telling Ana about his divorce, he'll be reminding her that there are other options, that not every guy will think of digients as competition for her attention.

He looks around for Ana in the restaurant, sees her and waves; she gives him a big grin. When he reaches the table he says, "You won't believe what Marco and Polo just did." He tells her what happened, and her jaw drops.

"That's amazing," she says."God, I'll bet Jax has heard the same things they have."

"Yeah, you might want to have a conversation with him when you get home." This leads to talking about the benefits and drawbacks of giving the digients access to social forums. The forums offer richer interaction than the owners can supply by themselves, but not all the influences the digients receive are positive ones.

After they've discussed digients for a while, Ana asks, "So aside from that, what's new with you?"

Derek sighs. "I might as well tell you: Wendy and I are getting divorced."

"Oh no. Derek, I'm so sorry." Her sympathy is genuine, and it warms him.

"It's been a long time coming," he says.

She nods. "Still, I'm sorry it's happening."

"Thanks." He talks for a while about what he and Wendy have agreed upon, how they'll sell the condo and split the proceeds. Thankfully the process is mostly amicable.

"At least she doesn't want copies of Marco and Polo," says Ana.

"Yeah, thank goodness for that," agrees Derek. A spouse can almost always make a copy of a digient, and when a divorce isn't amicable, it's all too easy to use one to get back at one's ex. They've seen it happen on the forums many times.

"Enough of that," says Derek. "Let's talk about something else. What's happening with you?"

"Nothing, really."

"You looked like you were in a good mood until I started talking about Wendy."

"Well, yeah, I was," she admits. "So is there something in particular that's got you feeling so upbeat?"

"It's nothing."

"Nothing's got you in a good mood?"

"Well, I have some news, but we don't have to talk about it now."

"No, don't be silly, it's fine. If you've got good news, let's hear it."

Ana pauses and then, almost apologetically, says, "Kyle and I have decided to move in together."

Derek is stunned. "Congratulations," he says.

Chapter Six

Two more years pass. Life goes on.

Occasionally Ana, Derek, and the other education-minded owners have their digients take some standardized tests, to see how they compare with human children. The results vary. The Faberge digients, being illiterate, can't take written tests, but they seem to be developing well according to other metrics. Among the Origami digients, there's a curious split in the test results, with half continuing to develop over time and half hitting a plateau, possibly due to a quirk in the genome. The Neuroblast digients do reasonably well if they're permitted the same allowances in testing that dyslexic humans are given; while there's variation between the individual digients, as a group their intellectual development continues apace.

What's harder to gauge is their social development, but one encouraging sign is that the digients are socializing with human adolescents in various online communities. Jax becomes interested in tetrabrake, a subculture focused on virtual dance choreography for four-armed avatars; Marco and Polo have each joined a fan club for a serial game drama, and each regularly tries to convince the other of the superiority of his choice. Even though Ana and Derek don't really understand the appeal of these communities, they like the fact that their digients have become part of them. The adolescents who dominate these communities seem unconcerned with the fact that the digients aren't human, treating them as just another kind of online friend they are unlikely to meet in person.

Ana's relationship with Kyle has its ups and downs, but is generally good. They occasionally go out with Derek and whomever he's dating; Derek sees a series of women, but nothing ever becomes serious. He tells Ana that it's because the women he dates don't share his interest in digients, but the truth is that his feelings for Ana refuse to go away.

The economy goes into a recession after the latest flu pandemic, prompting changes in the virtual worlds. Daesan Digital, the company that created the Data Earth platform, makes a joint announcement with Viswa Media, creator of the Real Space platform: Data Earth is becoming part of Real Space. All Data Earth continents will be replaced by identical Real Space versions added to the Real Space universe. They're calling it a merger of two worlds, but it's just a polite way of saying that, after years of upgrades and new versions, Daesan can no longer afford to keep fighting the platform wars.

For most customers, all this means is that they can travel between more virtual locations without logging out and in again. Over the last

few years, almost all of the companies whose software runs on Data Earth have created versions that run on Real Space. Gamers who play Siege of Heaven or Elderthorn can simply run a conversion utility, and their inventories of weapons and clothing will be waiting for them on the Real Space versions of the game continents.

One exception, though, is Neuroblast. There isn't a Real Space version of the Neuroblast engine — Blue Gamma folded before the platform was introduced — which means that there's no way for a digient with a Neuroblast genome to enter the Real Space environment. Origami and Faberge digients experience the migration to Real Space as an expansion of possibilities, but for Jax and the other Neuroblast digients, Daesan's announcement essentially means the end of the world.

#

Ana is getting ready for bed when she hears the crash. She hurries out to the living room to investigate.

Jax is wearing the robot body, examining his wrist. One of the tiles on the wall display next to him is cracked. He sees Ana enters and says, "I sorry."

"What were you doing?" she asks.

"I very sorry."

"Tell me what you were doing."

Reluctantly, Jax says, "Cartwheel."

"And your wrist gave way and you hit the wall."Ana takes a look at the robot-body's wrist. As she feared; it will require replacement. "I don't make these rules because I don't want you to have fun. But this is what happens when you try dancing in the robot body."

"I know you said. But I try little dancing, and body fine. I try little more, and body still fine."

"So you tried a little more, and now we have to buy a new wrist, and a new display tile." She briefly wonders how quickly she can replace them, if she can keep Kyle — who is out of town on business — from finding out about this. A few months ago Jax damaged a piece of sculpture that Kyle loved, and it might be better not to remind him of that incident.

"I very very sorry," says Jax.

"Okay, back to Data Earth."Ana points to the charging platform.

"I admit was mistake—"

"Just go."

Jax dutifully heads over. Just before he steps on the platform, he says quietly, "It not Data Earth." Then the robot-body's helmet goes

dark.

Jax is complaining about the private version of Data Earth that the Neuroblast user group has set up, duplicating many of the continents from the original. In one respect it's much better than the private island they used as a refuge from the IFF hack, because now processing power is so cheap that they can run dozens of continents. In another respect it's much worse, because those continents are almost entirely devoid of inhabitants.

The problem is not just that all the humans have moved to Real Space. The Origami and Faberge digients have gone to Real Space too, and Ana can hardly blame their owners; she'd have done the same, given the opportunity. Even more distressing is that most of the Neuroblast digients are gone as well, including many of Jax's friends. Some members of the user group quit when Data Earth closed; others took a "wait and see" approach, but grew discouraged after they saw how impoverished the private Data Earth was, choosing to suspend their digients rather than raise them in a ghost town. And more than anything else, that's what the private Data Earth resembles: a ghost town the size of a planet. There are vast expanses of minutely-detailed terrain to wander around in, but no one to talk to except for the tutors who come in to give lessons. There are dungeons without quests, malls without businesses, stadiums without sporting events; it's the digital equivalent of a post-apocalyptic landscape.

Jax's human friends from the tetrabrake scene used to log into the private Data Earth just to visit Jax, but their visits have grown increasingly infrequent; all the tetrabrake events happen on Real Space now. Jax can send and receive choreography recordings, but a major part of the scene is live gatherings where choreography is improvised, and there's no way for him to participate in those. Jax is losing most of his social life in the virtual world, and he can't find one in the real one: his robot body is categorized as an unpiloted free-roaming vehicle, so he's restricted from public spaces unless Ana or Kyle is there to accompany him. Confined to their apartment, he becomes bored and restless.

For weeks Ana tried having Jax sit at her computer in his robot body and log into Real Space that way, but he refuses to do it anymore. There were difficulties with the user interface — his inexperience with using an actual computer, compounded by the camera's suboptimal tracking of gestures performed by a robot body — but she believes they could have overcome them. The bigger problem is that Jax doesn't want to control an avatar remotely: he wants to *be* the avatar. For him, the keyboard and screen are a miserable substitute for being there, as unsatisfying as a jungle videogame would be to a chimpanzee taken from the Congo.

All the remaining Neuroblast digients are having similar frustrations, making it clear that a private Data Earth is only a temporary fix. What's needed is a way to run the digients on Real Space, allowing them to move freely and interact with its objects and inhabitants. In other words, the solution is to port the Neuroblast engine — to rewrite it to run on the Real Space platform. Ana has persuaded Blue Gamma's former owners to release the source code for Neuroblast, but it will take experienced developers to do the rewriting. The user group has posted announcements on open-source forums in an attempt to attract volunteers.

The sole advantage of Data Earth's obsolescence is that their digients are safe from the dark side of the social world. A company called Edgeplayer markets a digient torture chamber on the Real Space platform; to avoid accusations of unauthorized copying, they use only public-domain digients as victims. The user group has agreed that once they get the Neuroblast engine ported, their conversion procedure will include full ownership verification; no Neuroblast digient will ever enter Real Space without someone committed to taking care of it.

#

It's two months later, and Derek is browsing the user's group forum, reading the responses to an earlier post of his on the status of the Neuroblast port. Unfortunately, the news was not good; the attempts to recruit developers for the project haven't met with much success. The user group has held open-house events in their private Data Earth so that people could meet the digients, but there have been very few takers.

The problem is that genomic engines are old news. Developers are drawn to new, exciting projects, and right now that means working on neural interfaces or nanomedical software. There are scores of genomic engines languishing in various states of incompletion on the open-source repositories, all in need of volunteer programmers, and the prospect of porting the dozen-year-old Neuroblast engine to a new platform may be the least exciting of them all. Only a handful of students are contributing to the Neuroblast port, and considering how little time they're able to devote, the Real Space platform will itself be obsolete before the port is finished.

The other alternative is to hire professional developers. Derek has talked to some developers with experience in genomic engines, and requested quotes on how much it would cost to port Neuroblast. The estimates he's received are reasonable given the complexity of the

project, and for a company with several hundred thousand customers, it would make perfect sense to go ahead with it. For a user group whose membership has dwindled down to about twenty people, however, the price is staggering.

Derek reads the latest comments on the discussion forum, and then calls up Ana. Having the digients confined to a private Data Earth has definitely been hard, but for him there's also been a silver lining: he and Ana have reason to talk every day now, whether it's about the status of the Neuroblast port or trying to organize activities for their digients. Over the last few years Marco and Polo had drifted away from Jax as they all pursued their own interests, but now the Neuroblast digients have only each other for company, so he and Ana try to find things for them to do as a group. He no longer has a wife who might complain about this, and Ana's boyfriend Kyle doesn't seem to mind, so he can call her up without recrimination. It's a painful sort of pleasure to spend this much time with her; it might be healthier for him if they interacted less, but he doesn't want to stop.

Ana's face appears in the phone window. "Have you seen Stuart's post?" Derek asks. Stuart pointed out what each person would have to pay for them if they divided the cost evenly, and asked how many of the members could afford that much.

"I just read it," says Ana. "Maybe he thinks he's being helpful, but all he's doing is getting people anxious."

"I agree," he says. "But until we come up with a good alternative, the per-person cost is what everyone will be thinking about. Have you met with that fundraiser yet?" Ana was going to talk to a friend of a friend, a woman who has run fundraising campaigns for wildlife sanctuaries.

"As a matter of fact, I just got back from lunch with her."

"Great! What did you find out?"

"The bad news is, she doesn't think we can qualify for nonprofit status, because we're only trying to raise money for a specific set of individuals."

"But anyone could use the new engine—" He stops. It's true that there are probably millions of snapshots of Neuroblast digients stored in archives around the world. But the user group can't honestly claim to be working on their behalf; without someone willing to raise them, none of those digients would benefit from a Real Space version of the Neuroblast engine. The only digients the user group is trying to help are its own.

Ana nods without him saying a word; she must have had the exact same thought earlier. "Okay," says Derek, "we can't be a nonprofit. So what's the good news?"

"She says we can still solicit contributions outside of the nonprofit

model. What we need to do is tell a story that generates sympathy for the digients themselves. That's the way some zoos pay for things like surgeries on elephants."

He considers that for a moment. "I guess we could post some videos about the digients, try tugging on people's heartstrings."

"Exactly. And if we can build up enough popular sentiment, we might get contributions of time as well as money. Anything that raises the profiles of the digients will increase our chances of getting volunteers from the open-source community."

"I'll start going through my videos for footage of Marco and Polo," he says. "There's plenty of cute stuff from when they were young; I'm not so sure about the more recent stuff. Or do we need heartrending stuff?"

"We should talk about what would work best," says Ana. "I'll post a message on the forum asking everyone else."

This reminds Derek of something. "By the way, I got a call yesterday that might help us out. It's kind of a long shot, though."

"Who was it?"

"Do you remember the Xenotherians?"

"Those digients that were supposed to be aliens? Is that project still going on?"

"Sort of." He explains that he was contacted by a young man named Felix Radcliffe, who is one of the last participants in the Xenotherian project. Most of the original hobbyists gave up years ago, exhausted by the difficulty of inventing an alien culture from scratch, but there remains a small group of devotees who have become almost monomaniacal. From what Derek has been able to determine, most of them are unemployed and rarely leave their bedrooms in their parents' homes; they live their lives in Data Mars. Felix is the only member of the group willing to initiate contact with outsiders.

"And people call us fanatics," says Ana. "So why did he contact you?"

"He heard we were trying to get Neuroblast ported, and wants to help. He recognized my name because I was the one who designed the avatars for them."

"Lucky you," she says, smiling, and Derek makes a face. "Why would he care if Neuroblast gets ported? I thought the whole point of Data Mars was to keep the Xenotherians isolated."

"Originally it was, but now he's decided they're ready to meet human beings, and he wants to conduct a first-contact experiment. If Data Earth were still running, he'd let the Xenotherians send an expedition to the main continents, but that's no longer an option. So Felix is in the same boat as us; he wants Neuroblast ported so his digients can enter Real Space."

“Well…I guess I can understand that. And you said he might be able to help with funding?”

“He’s trying to generate interest among anthropologists and exobiologists. He thinks they’ll want to study the Xenotherians so much they’ll pay for the port.”

Ana looks dubious. “Would they actually pay for something like that?”

“I doubt it,” says Derek. “It’s not as if the Xenotherians are actually aliens. I think Felix would have better luck with game companies who need aliens to populate their worlds, but it’s his decision. I figure that as long as he doesn’t approach any of the people we’re contacting, he won’t hurt our chances, and there’s a possibility he can help.”

“But if he’s as awkward as he sounds, how likely is it he can persuade anyone?”

“Well, it wouldn’t be with his salesmanship. He’s got a video of the Xenotherians that he shows anthropologists, to whet their appetites. He let me see a little bit of it.”

“And?”

He shrugs, raises his hands. “I could’ve been looking at a hive of weedbots for all that I understood.”

Ana laughs. “Well, maybe that’s good. Maybe the more alien they are, the more interesting they’ll be.”

Derek laughs too, imagining the irony: after all the work they did at Blue Gamma to make digients appealing, what if it turns out that the alien ones are what people are more interested in?

Chapter Seven

Another two months go by. The user group's attempts at fund-raising don't meet with much success; the charitably inclined are growing fatigued of hearing about natural endangered species, let alone artificial ones, and digients aren't nearly as photogenic as dolphins. The flow of donations has never risen above a trickle.

The stress of being confined to Data Earth is definitely taking a toll on the digients; the owners try to spend more time with them to keep them from getting bored, but it's no substitute for a fully populated virtual world. Ana also tries to shield Jax from the problems surrounding the Neuroblast port, but he's aware of it nonetheless. One day when she comes home from work, she logs in to find him visibly agitated.

"Want ask you about porting," he says, with no prelude.

"What about it?"

"Before thought it just another upgrade, like before. Now think it much bigger. More like uploading, except with digients instead people, right?"

"Yes, I suppose it is."

"You seen video with mouse?"

Ana knows the one Jax is referring to: newly released by an uploading research team, it shows a white mouse being flash-frozen and then vaporized, one micrometer at a time, into curls of smoke by a scanning electron beam, and then instantiated in a test scape where it's virtually thawed and awakened. The mouse immediately has a seizure, convulsing piteously for a couple of subjective minutes before it dies. It's currently the record-holder for longest survival time for an uploaded mammal.

"Nothing like that will happen to you," she assures him.

"You mean I not remember if happens," says Jax. "I only remember if transition successful."

"No one's going to run you, or anyone else, on an untested engine. When Neuroblast has been ported, we'll run test suites on it and fix all the bugs before we run a digient. Those test suites don't feel anything."

"Researchers ran test suites before they uploaded mice?"

Jax is good at asking the tough questions. "The mice were the test suites," Ana admits. "But that's because no one has the source code to organic brains, so they can't write test suites that are simpler than real mice. We have the source code for Neuroblast, so we don't have that problem."

"But you don't have money afford port."

“No, not right now, but we’re going to get it.” She hopes she sounds more confident than she feels.

“How I help? How I make money?”

“Thanks, Jax, but right now there isn’t a way for you to make money,” she says. “For now your job is to just keep studying and do well in your classes.”

“Yes, know that: now study, later do other things. What if now I get loan, then pay back later when earn money?”

“Let me worry about that, Jax.”

Jax looks glum. “Okay.”

In fact, what Jax suggests is almost exactly what the user group has attempted recently by looking for corporate investors. It’s an avenue opened up by VirlFriday’s success in selling digients as personal assistants. It took several years, but Talbot finally managed to raise an instance of Andro that would work for anyone; VirlFriday has sold hundreds of thousands of copies. It’s the first demonstration that a digient can actually be profitable, and several other companies are looking to duplicate Talbot’s achievement.

One of those companies is called Polytope, who’ve announced plans for launching an enormous breeding program to create the next Andro. The user group contacted them and offered them a stake in the Neuroblast digients’ future: in exchange for paying to port the Neuroblast engine, Polytope would get a percentage of any income generated by the digients in perpetuity. The group was more hopeful than it had been in months, but the company’s answer was no; the only digients that Polytope is interested in are Sophonce digients, whose obsessive focus is a necessity if they’re going to replace conventional software.

The user group has briefly discussed the possibility of paying for the port out of their own pockets, but it’s clearly not feasible. As a result, some members are considering the unthinkable:

> **FROM: Stuart Gust**
>
> I hate being the one to bring this up, but someone has to. What about temporarily suspending the digients for a year or so, until we’ve raised the money for the port?
>
> **FROM: Derek Brooks**
>
> You know what happens when anyone suspends their digient. Temporary becomes indefinite becomes permanent.
>
> **FROM: Ana Alvarado**
>
> I couldn’t agree more. It’s just too easy to get into perpetual postponement mode. Have you ever heard of anyone restarting a digient that they’d suspended for more

than six months? I haven't.

FROM: Stuart Gust

But we're not like those people. They suspended their digients because they were tired of them. We'll miss our digients every day that they're suspended; it'll be an incentive for us to raise the money.

FROM: Ana Alvarado

If you think suspending Zaff will increase your motivation, go ahead. Keeping Jax awake is what keeps me motivated.

Ana has no doubts when she posts her reply on the forum, but the conversation is more difficult when, a few days later, Jax brings up the issue himself. The two of them are in the private Data Earth, where she is showing him around a new game continent. It's a classic, one that Ana enjoyed years ago, and it's recently been released for free, so the user group instantiated a copy for the digients. She tries to convey her enthusiasm for it, pointing out what distinguishes it from the other game continents that the digients have grown bored with, but Jax sees the continent for what it is: yet another attempt to keep him occupied while they wait for Neuroblast to be ported.

As they walk through a deserted medieval town square, Jax says, "Sometimes wish I just be suspended, not have to wait more. Restarted when I can enter Real Space, feel like no time passed."

The comment catches Ana off-guard. None of the digients have access to the user-group forums, so Jax must have come up with the idea on his own. "Do you really want that?" she asks.

"Not really. Want stay awake, know what happening. But sometimes get frustrated." Then, he asks, "You sometimes wish you don't have take care me?"

She makes sure Jax is looking her in the face before she replies. "My life might be simpler if I didn't have you to take care of, but it wouldn't be as happy. I love you, Jax."

"Love you too."

#

Driving home from work, Derek gets a message from Ana saying that she'd been contacted by someone at Polytope, so as soon as he gets home he calls her. "So what happened?" he asks.

Ana looks bemused. "It was a very strange call."

"Strange how?"

“They’re offering me a job.”

“Really? Doing what?”

“Training their Sophonce digients,” she says. “Because of all my previous experience, they want me to be the team leader. They offered a great salary, three years guaranteed employment, and a signing bonus that’s, frankly, fabulous. There’s a catch, though.”

“Well? Don’t keep me in suspense.”

“All their trainers are required to use InstantRapport.”

Derek’s eyes widen. “You’re kidding,” he says. InstantRapport is one of the smart transdermals, a patch that delivers doses of an oxytocin-opioid cocktail whenever the wearer is in the presence of a specific person. It’s used to strengthen rocky marriages and strained parent-child relationships, and it’s recently become available without a prescription. “What the hell for?”

“They figure that affection will produce better results, and the only way trainers will feel affection for Sophonce digients is with pharmaceutical intervention.”

“Oh, I get it. It’s a way to increase employee productivity.” He knows plenty of people who take nootropics or use transcranial magnetic stimulation to boost their performance at work, but so far no employer has made it a requirement. He shakes his head in disbelief. “If their digients are so hard to love, you would think they’d take a hint and switch to Neuroblast digients.”

“I said something similar to them, but they weren’t interested. I had an idea, though.” Ana leans forward. “I might be able to change their minds if I go work for them.”

“How do you figure?”

“It’d be an opportunity to show Jax to Polytope’s management on an ongoing basis. I could log into our private Data Earth from work, maybe even bring him in wearing the robot body. What better way to demonstrate how versatile the Neuroblast engine is? And once they realize that, they’ll port it to Real Space.”

Derek considers it. “Assuming they don’t forbid you from spending time with Jax during work hours—”

“Give me some credit. I wouldn’t give them the hard sell; I’d be subtle about it.”

“It might work,” he says. “But they’d make you wear the Instant Rapport patch. Is the chance worth that?”

Ana gives a frustrated shrug. “I don’t know. It sure as hell isn’t my first choice. But sometimes we have to take a chance, right? Push things a little.”

He isn’t sure what to say. “What does Kyle think about it?”

She sighs.”He’s totally against it. He doesn’t like the idea of me taking InstantRapport, and he definitely doesn’t think the chances are

good enough to justify it." She pauses, and then says, "But he doesn't feel the same way about digients that you or I do, so of course he'd say that. For him, the payoff doesn't seem that big."

Ana's clearly expecting support and he obliges, but privately his thoughts are more conflicted. He has reservations about what she's proposing, but he's hesitant about saying so.

He hates that he has such thoughts, but on the occasions that Ana has mentioned having difficulties with Kyle, he daydreams about the two of them splitting up. He's told himself that he would never do anything to drive them apart, but if Kyle doesn't share Ana's commitment to the digients, Derek isn't doing anything wrong by showing that he does. If that suggests to Ana that he's a better match for her than Kyle, he can't be blamed for that.

The question is whether he really thinks it's a good idea for Ana to accept Polytope's job offer. He's not sure he does, but until he's sure, he's going to be supportive.

After he gets off the phone, Derek logs onto the private Data Earth to spend time with Marco and Polo. They're playing a game of zero-gee racquetball, but descend from the court when they see him.

"Met nice visitors today," says Marco.

"Really? Do you know who they were?"

"Person name Jennifer, and person name Roland."

Derek checks the visitor log, and is dismayed by what he sees: Jennifer Chase and Roland Michaels are employees of a company called Binary Desire, maker of sex dolls both virtual and physical.

This isn't the first time the user group has received an inquiry from someone wanting to use the digients for sex. The vast majority of sex dolls are still controlled by conventional software to enact scripted scenarios, but for as long as there have been digients, there have been people trying to have sex with them; the typical procedure is to copy a public-domain digient and reconfigure its reward map so that it enjoys whatever its owner finds arousing. Critics consider it the equivalent of having a dog lick peanut butter off your genitals, and it's not an unfair comparison, either in terms of the intelligence of the digients or the sophistication of the training. Certainly there aren't any digients remotely as person-like as Marco or Polo available for sex right now, so the user group gets occasional inquiries from sex-doll makers interested in purchasing copies of the digients. Everyone in the group has agreed that they should ignore such inquiries.

But according to the log, Chase and Michaels were escorted in by Felix Radcliffe.

Derek tells Marco and Polo to resume their game, and then calls Felix. "What the hell were you thinking? Bringing in Binary Desire?"

"They did not attempt to sex the digients."

“I can see that.” He has the recording of their visit playing at double-speed in another window.

“They had conversation with them.”

Talking to Felix sometimes feels like addressing an alien. “We had an understanding about sex-doll makers. Do you remember that?”

“These people are not like the others. I like the way they think.”

He’s afraid to ask what that means.

“If you like them, bring them to Data Mars and show them your Xenotherians.”

“I did show them,” says Felix. “They were not interested.”

Of course they weren’t, Derek realizes; the demand for sex with Lojban-speaking tripods would be microscopic. But he sees that Felix is being honest, that it wouldn’t bother him to prostitute the Xenotherians if it would help finance his first-contact experiment. Felix may be eccentric, but he’s not a hypocrite.

“Then that should have been the end of it,” he says. “We may have to ban you from Data Earth.”

“You should talk to these people.”

“No, we shouldn’t.”

“They will pay you for listening to them. They will send a message containing the specifics.”

Derek almost laughs. Binary Desire must be pretty desperate if they’re paying people to listen to a sales pitch. “Messages are fine. But I’m putting those people on the ban list, and I don’t want you bringing in anyone else from a sex-doll maker. Is that clear?”

“That is clear,” says Felix, and hangs up.

Derek shakes his head. Normally he wouldn’t consider listening to such a sales pitch, even for money, because he doesn’t want to give the impression that he’d be willing to sell Marco and Polo as sex objects.

But right now the user group needs every dollar it can get. If listening to one company’s presentation could encourage other companies to pay for the same opportunity, then it might be worthwhile. He restarts the video of the visitors’ meeting with the digients and watches it at regular speed.

Chapter Eight

The user group has gathered to listen to Binary Desire's presentation via videoconferencing; Binary Desire has made a payment to an escrow service, and the funds will be released after the meeting. Seated at the focus of her wraparound screen, Ana looks around her; everyone's video feeds are integrated so that the user group appears to be gathered in a virtual auditorium, each sitting in a tiny private balcony. Derek's sitting in the balcony to her left, and Felix in turn is to his left. At the podium on stage is Binary's representative Jennifer Chase. Her image onscreen is blond and beautiful and tastefully dressed, and because the parties have agreed to use authenticated video, Ana knows this is how Chase actually looks. She wonders if Binary Desire assigns Chase to do all their negotiations; the woman is probably very good at getting what she asks for.

Felix stands up in his seat and starts to say something in Lojban before catching himself. "You will like what she will say," he says.

"Thank you, Felix, but let me take it from here," says Chase.

Felix sits back down, and Chase addresses the group. "Thank you for agreeing to meet with me. Typically when I meet with a prospective business partner, I talk about how Binary Desire can help them reach a wider market than they can themselves, but I'm not going to do that with you. My goal for this meeting is to assure you that your digients will be treated with respect. We don't want pets that have been sexualized through simple operant conditioning. We want beings that engage in sex at a higher, more personal level."

Stuart calls out, "How do you expect to get that when our digients are completely asexual?"

Chase doesn't miss a beat. "With two years of training, minimum."

Ana's surprised."That's a major investment," she says."I thought digient sex-dolls were usually trained for a couple of weeks."

"That's because they're usually Sophonce digients, and they don't become better sex partners in two years than they do in two weeks. I don't know if you've seen the results, but if you're curious, I can tell you where you can find a harem of Draytas dressed in Marilyn Monroe avatars, all bleating *Wanna suck dick*. It's not pretty."

Ana laughs despite herself, as do several others in the group. "No, it doesn't sound like it."

"That's not what Binary Desire is looking for. Anyone can take a public-domain digient and reconfigure its reward map. We want to offer sex partners with real personality, and we're willing to invest the

effort needed to create that."

"So what would your training entail?" asks Helen Costas, from the back.

"First off, sexual discovery and exploration. We'd give the digients anatomically-correct avatars and let them get accustomed to having erogenous zones. We'd encourage the digients to begin sexual experimentation with each other, so they can get some practice as sexual beings and choose a gender they're comfortable with. Since much of the learning during that phase will occur purely among themselves, there may be periods where the digients can be run at faster than real time. Once they've acquired a reasonable amount of experience, we'll begin bonding them with compatible human partners."

"What makes you so sure they'll bond with a specific human?" asks Derek.

"Our developers have examined some of the digients in the shelters; they're too young for our purposes, but they've developed emotional attachments, and our developers have done enough analysis that they believe they can induce similar attachments in older digients. As the digient gets to know a human, we'll enhance the emotional dimension of their interactions, both sexual and non-sexual, so they'll generate love in the digient."

"Like a Neuroblast version of InstantRapport," says Ana.

"Something like that," says Chase, "but more effective and specific, because it'll be custom-tuned. For the digient, it will be indistinguishable from falling in love spontaneously."

"That custom-tuning doesn't sound like something you'll be able to get right on the first try," says Ana.

"No, of course not," says Chase. "We expect that it will take months for a digient to fall in love; throughout that period we'll be working with the customer, rolling the digient back to checkpoints and trying different adjustments until the emotional bond is firmly established. It'll be like the breeding program you managed when you worked at Blue Gamma; we're just tailoring it for the individual customer."

Ana's about to say that it's very different, but decides not to. All she needs to do is listen to the woman's sales pitch, not refute it. "I can see what you mean," she says.

Derek says, "Even if you can make them fall in love, none of our digients is going to be a convincing Marilyn Monroe."

"No, but that's not our goal. The avatars we'd give them would be humanoid, but not human. You see, we're not trying to duplicate the experience of sex with a human being; we want to provide non-human partners that are charming, affectionate, and genuinely enthusiastic

about sex. Binary Desire believes this is a new sexual frontier."

"A new sexual frontier?" says Stuart. "You mean popularizing a kink until it becomes mainstream."

"You could call it that," says Chase. "But try looking at it another way: our ideas of what constitutes healthy sex have always broadened over time. People used to think homosexuality, BDSM, and polyamory were all symptoms of psychological problems, but there's nothing intrinsic about those activities that's incompatible with a loving relationship. The problem was having one's desires stigmatized by society. We believe that in time, digient sex will likewise be accepted as a valid expression of sexuality. But that requires being open and honest about it, and not pretending that a digient is a human."

An icon appears onscreen indicating that Chase has transmitted a document to the group. "I'm sending you a copy of the contract we're proposing," she says, "but let me give you a summary. Binary Desire will cover the costs of porting Neuroblast to Real Space in exchange for non-exclusive rights to your digients. You retain the right to make and sell copies of your digients as long as they don't compete with ours. If your digients sell well, we'll also pay royalties. And your digients will enjoy what they do."

"Okay, thank you," Ana says. "We'll take a look at the contract, and let you know. Is that all?"

Chase smiles. "Not quite. Before I release the funds, I'd like the chance to address any concerns you might have; I assure you I won't be offended. Is it the sexual aspect that you have reservations about?"

Ana hesitates, and then says, "No, it's the coercion."

"There wouldn't be any coercion. The bonding process ensures the digients will enjoy it as much as their owners."

"But you're not giving them any choice about what they enjoy."

"Is it so different for humans? When I was a little girl, the idea of kissing a boy was completely uninteresting, and if it'd been up to me, that would never have changed." Chase gives a slight, coy smile, as if to suggest how much she enjoys kissing now. "We become sexual beings whether we want to or not. The modifications Binary Desire would make to the digients aren't any different. In fact, they'll be better. Some people get saddled with sexual proclivities that cause them a lifetime of grief. That's not going to happen to the digients. As far as each digient concerned, it's going to be paired up with a perfectly compatible sex partner. That's not coercion, that's ultimate sexual fulfillment."

"But it's not real," Ana blurts out, and immediately regrets it.

It's precisely the opening Chase was looking for. "How is it not?" she asks. "Your feelings for your digients are real; their feelings for you are real. If you and your digient can have a nonsexual connection

that's real, why should a sexual connection between a human and a digient be any less real?"

Ana's at a loss for words momentarily, and Derek steps in. "We could argue philosophy forever," he says. "The bottom line is, we didn't spend years raising our digients to have them become sex toys."

"I realize that," says Chase. "And making this deal won't prevent copies of your digients from going on to other things. But right now your digients, amazing as they are, have no marketable job skills, and you can't predict when they'll get any. How else are you going to raise the money you need?"

How many women have asked themselves the same question, Ana wonders. "So it's the oldest profession."

"That's one way to put it, but let me again point out that the digients won't be subjected to any coercion, not even economic coercion. If we wanted to sell faked sexual desire, there are cheaper ways we could do it. The whole point of this enterprise is to create an alternative to fake desire. We believe that sex is better when both parties enjoy it; better as an experience, and better for society."

"That all sounds very noble. What about people who are into sexual torture?"

"We don't condone any non-consensual sex acts, and that includes sex with digients. The contract I've sent you guarantees that Binary Desire will retain the circuit-breakers that Blue Gamma initially installed, enforced with state-of-the-art access control. As I said, we believe sex is better when both parties enjoy it. We're committed to that."

"You approve, correct?" Felix says to the group. "They anticipate all possibilities." Several of the user group members glare at him, and even Chase's expression indicates that she'd rather do without Felix's help.

"I know that this wasn't what you were hoping for when you began looking for investors," says Chase. "But if you can look past your initial reaction, I think you'll agree that what we're proposing will be to everyone's advantage."

"We'll think about it and get back to you," says Derek.

"Thank you for listening to my presentation," says Chase. A window pops up on screen, indicating that the funds have been released from escrow. "Let me say one last thing. If you're approached by another company, be sure to look at the fine print. It will probably include a clause that our lawyers wanted us to include, one that gives them the right to resell your digients to another company, with the circuit-breakers disabled. I expect you know what that means?"

Ana nods; it meant that the digients might get resold to a company like Edgeplayer for use as torture victims. "Yes, we do."

“Binary Desire overruled our lawyers’ recommendation on that. Our contract guarantees that the digients won’t be used for anything but noncoercive sex, ever. See if anyone else will make you that same guarantee.”

“Thank you,” says Ana. “We’ll be in touch.”

#

Ana went into the meeting with Binary Desire with the attitude that it was purely pro-forma, a way to make some money by listening to a sales pitch. Now, having heard the pitch, she finds that she’s thinking about it a lot.

She hasn’t paid attention to the world of virtual sex since she was in college, when a college boyfriend spent a semester abroad. They bought the peripherals together before he left, discreet hard-shell accessories with hilarious silicone interiors, and digitally locked each device with the other’s serial number, a fidelity guarantee for their virtual genitals. Their first few sessions were unexpectedly fun, but it didn’t take long for the novelty to wear off and the shortcomings of the technology to become blatant. Sex without kissing was woefully incomplete, and she missed having her face an inch away from his, feeling the weight of his body, smelling his musk; seeing each other on a video screen couldn’t replace that, no matter how close the camera was. Her skin hungered for his in a way that no peripheral could satisfy; by semester’s end she felt like she was going to burst at the seams. The technology has undoubtedly improved since then, but it’s still an impoverished medium for intimacy.

Ana remembers how much a difference it made the first time she saw Jax wearing a physical body. If a digient were inhabiting a doll, would that make the idea of sex more appealing? No. She’s had her face right up against Jax’s face, cleaning smudges off his lenses or inspecting scratches, and it’s nothing like being close to a person; with a digient there’s no feeling of a personal space being entered, not even the trust signified when a dog lets you rub its belly. At Blue Gamma they’d chosen not to put that kind of physical self-protectiveness into the digients — it didn’t make sense for their product — but what does physical intimacy mean if there aren’t those barriers to overcome? She doesn’t doubt that it’s possible to give a digient an arousal response close enough to human that both parties’ mirror neurons would kick in. But could Binary Desire teach a digient about the vulnerability that came with being naked, and what you were telling someone with your willingness to be naked in their presence?

But maybe none of that matters. Ana replays the recording of the

videoconference, listens to Chase saying that it's a new frontier, sex with a non-human partner. It's not supposed to be the same as sex with another person, it'll be a different kind of sex, and maybe it'll be accompanied by a different kind of intimacy.

She thinks of an incident that took place when she worked at the zoo, when one of the female orangutans passed away. Everyone was heartbroken, but the orangutan's favorite trainer was particularly inconsolable. Eventually he confessed that he'd been having sex with her, and shortly afterwards the zoo fired him. Ana was shocked, of course, but even more so because he wasn't the creepy pervert she imagined a zoophile would be; his grief was as deep and genuine as that of anyone who had lost a lover. He'd been married once, too, which surprised her; she'd assumed such people couldn't get a date, but then she realized she was buying into the stereotype about zookeepers: that they spent time with animals because they couldn't get along with people. As she did at the time, Ana again tries to pin down exactly why nonsexual relationships with animals can be healthy while sexual ones can't, why the limited consent that animals can give is sufficient to keep them as pets yet not to have sex with them. Again she can't articulate an argument that isn't rooted in personal distaste, and she's not sure that's a good enough reason.

As for the question of digients having sex with each other, the topic has occasionally been discussed in the past, and Ana has always felt that the owners are fortunate not to have to deal with it, because sexual maturity is when a lot of animals become difficult to handle. There isn't even the guilt that might be associated with neutering Jax surgically, because she's not depriving him of a fundamental aspect of his nature. But now there's a thread on the discussion forum that is making her reconsider things:

> **FROM: Helen Costas**
>
> I don't like the idea of anyone have sex with my digient, but then I remember that parents never want to think about their kids having sex, either.
>
> **FROM: Maria Zheng**
>
> That's a false analogy. Parents can't stop their children from becoming sexual, but we can. There's no intrinsic need for digients to emulate that aspect of human development. Don't go overboard with the anthropomorphic projection.
>
> **FROM: Derek Brooks**
>
> What's intrinsic? There was no intrinsic need for digients to have charming personalities or cute avatars, but there was still a good reason for it: they made people more

likely to spend time with them, and that was good for the digients.

I'm not saying we should accept Binary Desire's offer. But I think what we need to ask ourselves is, if we make the digients sexual, would that encourage other people to love them, in a way that's good for the digients?

Ana wonders if Jax's asexuality means he's missing out on things that would be beneficial for him to experience. She likes the fact that Jax has human friends, and the reason she wants Neuroblast ported to Real Space is so he can maintain those relationships, strengthen them. But how far could that strengthening go? How close a relationship could one have before sex became an issue?

Later that evening, she posts a reply to Derek's comment:

FROM: Ana Alvarado

Derek raises a good question. But even if the answer is yes, that doesn't mean we should accept Binary Desire's offer.

If a person is looking for a masturbatory fantasy, he can use ordinary software to get it. He shouldn't buy a mail-order bride and slap a dozen InstantRapport patches on her, but that's essentially what Binary Desire wants to give its customers. Is that the kind of life we want our digients to have? We could dose them with so much virtual endorphin that they'd be happy living in a closet in Data Earth, but we care about them too much to do that. I don't think we should let someone else treat them with less respect.

I admit the idea of sex with a digient bothered me initially, but I guess I'm not opposed to the idea in principle. It's not something I can imagine doing myself, but I don't have a problem if other people want to, so long as it's not exploitative. If there's some degree of give and take, then maybe it could be like Derek said: good for the digient as well as the human. But if the human is free to customize the digient's reward map, or keep rolling him back until he finds a perfectly tweaked instantiation, then where's the give and take? Binary Desire is telling its customers that they don't have to accommodate their digients' preferences in any way. It doesn't matter whether it involves sex or not; that's not a real relationship.

#

Any member of the user group is free to accept Binary Desire's offer individually, but Ana's argument is persuasive enough that no

one does so for the time being. A few days after the meeting, Derek tells Marco and Polo about Binary Desire's offer, figuring that they deserve to be kept informed of what's going on. Polo is curious about the modifications Binary Desire wanted to make; he knows he has a reward map, but has never thought about what it would mean to edit it.

"Might be fun editing my reward map," says Polo.

"You not able edit your reward map when you working for someone else," says Marco. "You only able do that when you corporation."

Polo turns to Derek. "That true?"

"Well, that's not something I would let you do even when you are a corporation."

"Hey," protests Marco. "You said when we corporations, we make all our own decisions."

"I did say that," admits Derek, "but I hadn't thought about you editing your own reward map. That could be very dangerous."

"But humans able edit own reward maps."

"What? We can't do anything like that."

"What about drugs people take for sex? Ifridisics?"

"Aphrodisiacs. Those are just temporary."

"InstantRapport temporary?" asks Polo.

"Not exactly," says Derek, "but a lot of the time when people take that, they're making a mistake." Especially, he thinks, if a company is paying them to take it.

"When I corporation, I free make own mistakes," says Marco. "That whole point."

"You're not ready to be a corporation yet."

"Because you not like my decisions? Ready mean always agree with you?"

"If you're planning on editing your own reward map as soon as you're a corporation, you're not ready."

"I not said want," says Marco emphatically. "I don't want. I said when corporation, I free do that. That different."

Derek stops for a moment. It's easy to forget, but this is the same conclusion the user group came to during forum discussions about incorporating the digients: if legal personhood is to be more than a form of wordplay, it has to mean granting a digient some degree of autonomy. "Yes, you're right. When you're a corporation, you'll be free to do things that I think are mistakes."

"Good," says Marco, satisfied. "When you decide I ready, it not because I agree you. I can be ready even if I not agree you."

"That's right. But please, tell me you don't want to edit your own reward map."

“No, I know dangerous. Might make mistake that stop self from fixing mistake.”

He’s relieved. “Thank you.”

“But let Binary Desire edit my reward map, that not dangerous.”

“No, it’s not dangerous, but it’s still a bad idea.”

“I not agree.”

“What? I don’t think you understand what they want to do.”

Marco gives him a look of frustration.”I do. They make me like what they want me like, even if I not like it now.”

Derek realizes Marco does understand. “And you don’t think that’s wrong?”

“Why wrong? All things I like now, I like because Blue Gamma made me like. That not wrong.”

“No, but that was different.” He thinks for a moment to explain why. “Blue Gamma made you like food, but they didn’t decide what specific kind of food you had to like.”

“So what? Not very different.”

“It *is* different.”

“Agree wrong if they edit digients not want be edited. But if digient agree before be edited, then not wrong.”

Derek feels himself growing exasperated. “So do you want to be a corporation and make your own decisions, or do you want someone else to make your decisions? Which one is it?”

Marco thinks about that. “Maybe I try both. One copy me become corporation, second copy me work for Binary Desire.”

“You don’t mind having copies made of you?”

“Polo copy of me. That not wrong.”

At a loss, Derek brings the discussion to a close and sends the digients off to do work on their studies, but he can’t easily dismiss what Marco has said. On the one hand Marco made some good arguments, but on the other Derek remembers his college years well enough to know that skill at debate isn’t the same as maturity. Not for the first time, he thinks of how much easier it would be if there were a legally mandated age of majority for digients; without one, it will be entirely up to him to decide when Marco is ready to be a corporation.

Derek’s not alone in having disagreements in the wake of Binary Desire’s offer. The next time he talks to Ana, she complains about a recent fight with Kyle.

“He thinks we should accept Binary Desire’s offer,” she says.”He said it’s a much better option than me taking the job at Polytope.”

It’s another opportunity to be critical of Kyle; how should he handle it? All he says is, “Because he thinks modifying the digients isn’t that big a deal.”

“Exactly.” She fumes a bit, and then continues. “It’s not as if I

think wearing the InstantRapport patch is no big deal. Of course it is. But there's a big difference between me using InstantRapport voluntarily and Binary Desire just imposing their bonding process on the digients."

"A huge difference. But you know, that raises an interesting question." He tells her about his conversation with Marco and Polo. "I'm not sure if Marco was just arguing for the sake of arguing, but it made me think. If a digient volunteers to undergo the changes that Binary Desire wants to make, does that make a difference?"

Ana looks thoughtful. "I don't know. Maybe."

"When an adult chooses to use an InstantRapport patch, we have no grounds to object. What would it take for us to respect Jax's or Marco's decisions the same way?"

"They'd have to be adults."

"But we could file articles of incorporation tomorrow, if we wanted to," he says. "What makes us so sure we shouldn't? Suppose one day Jax says to you he understands what he'd be getting into by accepting Binary Desire's offer, just like you with the job at Polytope. What would it take for you to accept his decision?"

She thinks for a moment."I guess it would depend on whether or not I thought he was basing his decision on experience. Jax has never had a romantic relationship or held a job, and accepting Binary Desire's offer would mean doing both, potentially forever. I'd want him to have had some experience with those matters before making a decision where the consequences are so permanent. Once he's had that experience, I suppose I couldn't really object."

"Ah, " says Derek, nodding. "I wish I'd thought of that when I was talking to Marco." It would mean modifying the digients into sexual beings, but without the intention of selling them; another expense for the users' group, even after they got Neuroblast ported. "That's going to take a long time, though."

"Sure, but there's no hurry to make the digients sexual. Better to wait until we can do it properly."

Better to set an older age of majority than risk setting it too young. "And until then, it's up to us to look after them."

"Right! We have to put their needs first." Ana looks grateful for the agreement, and he's glad he can provide it. Then frustration returns to her face. "I just wish Kyle understood that."

He searches for a diplomatic response. "I'm not sure anyone can, if they haven't spent the time we have," he says. It's not intended as a criticism of Kyle; it's what he sincerely believes.

Chapter Nine

A month has passed since Binary Desire's presentation, and Ana is in the private Data Earth with a few of the Neuroblast digients, awaiting the arrival of visitors. Marco tells Lolly about the latest episode of his favorite game drama, while Jax practices a dance he's choreographed.

"Look," he says. She watches him rapidly cycle through a sequence of poses.

"Remember, when they get here, you have to talk about what you built."

"I know, you said and said already. I stop dancing soon they here. Just having fun."

"Sorry, Jax. I'm just nervous."

"Watch me dancing. Feel better."

She smiles. "Thanks, I'll try that." She takes a deep breath and tells herself to relax.

A portal opens and two avatars walk through. Jax promptly stops dancing, and Ana walks her avatar over to greet the visitors. The onscreen annotations identify them as Jeremy Brauer and Frank Pearson.

"I hope you didn't have any trouble getting in," says Ana.

"No," says Pearson, "the logins you gave us worked fine."

Brauer is looking around. "Good old Data Earth." His avatar pulls on the branch of a shrub and then let's go, watching the way it sways. "I remember how exciting it was when Daesan first released it. It was state of the art."

Brauer and Pearson work for Exponential Appliances, maker of household robots. The robots are examples of old-fashioned AI; their skills are programmed rather than learned, and while they offer some real convenience, they aren't conscious in any meaningful sense. Exponential regularly releases new versions, advertising each one as being a step closer to the consumer's dream of AI: a butler that is utterly loyal and attentive from the moment it's switched on. To Ana this upgrade sequence seems like a walk to the horizon, providing the illusion of progress while never actually getting any closer to the goal. But consumers buy the robots, and they've given Exponential a healthy balance sheet, which is what Ana's looking for.

Ana isn't trying to get the Neuroblast digients jobs as butlers; it's obvious that Jax and the others are too willful for that type of work. Brauer and Pearson don't even work for the commercial division of the company; instead, they're part of the research division, the reason that Exponential was founded. The household robots are Exponential's

way of funding its efforts to conjure up the technologist's dream of AI: an entity of pure cognition, a genius unencumbered by emotions or a body of any kind, an intellect vast and cool yet sympathetic. They're waiting for a software Athena to spring forth fully grown, and while it'd be impolite for Ana to say she thinks they'll be waiting forever, she hopes to convince Brauer and Pearson that the Neuroblast digients offer a viable alternative.

"Well, thank you for coming out to meet me," says Ana.

"We've been looking forward to it," says Brauer. "A digient whose cumulative running time is longer than the lifespan of most operating systems? You don't see that very often."

"No, you don't." Ana realizes that they came more for nostalgia's sake than to seriously entertain a business proposal. Well, so be it, as long as they're here.

Ana introduces them to the digients, who then give little demonstrations of projects they've been working on. Jax shows a virtual contraption he's built, a kind of music synthesizer that he plays by dancing. Marco gives an explanation of a puzzle game he's designed, one that can be played cooperatively or competitively. Brauer is particularly interested in Lolly, who shows them a program she's been writing; unlike Jax and Marco, who built their projects using toolkits, Lolly is writing actual code. Brauer's disappointment is evident when it becomes clear that Lolly is just like any other novice programmer; it's clear he was hoping her digient nature had given her a special aptitude for the subject.

After they've talked with the digients for a while, Ana and the visitors from Exponential log out of Data Earth and switch to videoconferencing.

"They're terrific," says Brauer. "I used to have one, but he never got much beyond baby talk."

"You used to have a Neuroblast digient?"

"Sure, I bought one as soon as they came out. He was an instance of the Jax mascot, like yours. I named him Fitz, kept him going for a year."

This man had a baby Jax once, she thinks. Somewhere in storage is a baby version of Jax that knows this man as his owner. Aloud, she says, "Did you get bored with him?"

"Not so much bored as aware of his limitations. I could see that the Neuroblast genome was the wrong approach. Sure Fitz was smart, but it would take forever before he could do any useful work. I've got to hand it to you for sticking with Jax for so long. What you've achieved is impressive." He makes it sound like she's built the world's largest toothpick sculpture.

"Do you still think Neuroblast was the wrong approach? You've

seen for yourself what Jax is capable of. Do you have anything comparable at Exponential?" It comes out more sharply than she intended.

Brauer's reaction is mild. "We're not looking for human-level AI; we're looking for superhuman AI."

"And you don't think that human-level AI is a step in that direction?"

"Not if it's the sort that your digients demonstrate," says Brauer.

"You can't be sure that Jax will ever be employable, let alone become a genius at programming. For all you know, he's reached his maximum."

"I don't think he has—"

"But you don't know for certain."

"I know that if the Neuroblast genome can produce a digient like him, it can produce one as smart as you're looking for. The Alan Turing of Neuroblast digients is just waiting to be born."

"Fine, let's suppose you're right," says Brauer; he's clearly indulging her. "How many years would it take to find him? It's already taken you so long to raise the first generation that the platform they run on has become obsolete. How many generations before you come up with a Turing?"

"We won't always be restricted to running them in real time. At some point there'll be enough digients to form a self-sufficient population, and then they won't be dependent on human interaction. We could run a society of them at hothouse speeds without any risk of them going feral, and see what they produce." Ana's actually far from confident that this scenario would produce a Turing, but she's practiced this argument enough times to sound like she believes it.

Brauer isn't convinced, though. "Talk about a risky investment. You're showing us a handful of teenagers and asking us to pay for their education in the hopes that when they're adults, they'll found a nation that will produce geniuses. Pardon me if I think there are better ways we could spend our money."

"But think about what you're getting. The other owners and I have devoted years of our attention to raising these digients. Porting Neuroblast is cheap compared to what it'd cost to hire people to do that for another genome. And the potential payoff is exactly what your company's been looking for: programming geniuses working at high speed, bootstrapping themselves to superhuman intelligence. If these digients can invent games now, just imagine what their descendants could do. And you'd make money off every one of them."

Brauer is about to reply when Pearson interjects. "Is that why you want Neuroblast ported? To see what superintelligent digients might invent one day?"

Ana sees Pearson scrutinizing her, and decides there's no point in trying to lie. "No," she says. "What I want is for Jax to have a chance at a fuller life."

Pearson nods."You'd like Jax to be a corporation one day, right? Have some sort of legal personhood?"

"Yes, I would."

"And I'll bet Jax wants the same thing, right? To be incorporated?"

"For the most part, yes."

Pearson nods again, his suspicions confirmed. "That's a deal-breaker for us. It's nice that they're fun to talk to, but all the attention you've given your digients has encouraged them to think of themselves as persons."

"Why is that a deal-breaker?" But she knows the answer already.

"We aren't looking for superintelligent employees, we're looking for superintelligent products. You're offering us the former, and I can't blame you; no one can spend as many years as you have teaching a digient and still think of it as a product. But our business isn't based on that kind of sentiment."

Ana has been pretending it wasn't there, but now Pearson has stated it baldly: the fundamental incompatibility between Exponential's goals and hers. They want something that responds like a person, but isn't owed the same obligations as a person, and that's something she can't give them.

No one can give it to them, because it's an impossibility. The years she spent raising Jax didn't just make him fun to talk to, didn't just provide him with hobbies and a sense of humor. It was what gave him all the attributes Exponential was looking for: fluency at navigating the real world, creativity at solving new problems, judgment you could entrust an important decision to. Every quality that made a person more valuable than a database was a product of experience.

She wants to tell them that Blue Gamma was righter than it knew: experience isn't merely the best teacher, it's the only teacher. If she's learned anything raising Jax, it's that there are no shortcuts; if you want to create the common sense that comes from twenty years of being in the world, you need to devote twenty years to the task. You can't assemble an equivalent collection of heuristics in less time; experience is algorithmically incompressible.

And even though it's possible to take a snapshot of all that experience and duplicate it *ad infinitum*, even though it's possible to sell copies cheaply or give them away for free, each of the resulting digients would still have lived a lifetime. Each one would have once seen the world with new eyes, have had hopes fulfilled and hopes

dashed, have learned how it felt to tell a lie and how it felt to be told one.

Which means each one would deserve some respect. Respect that Exponential can't afford to give.

Ana makes one final attempt. "These digients could still make money for you as employees. You could—"

Pearson shakes his head. "I appreciate what you're trying to do, and I wish you the best of luck, but it's not a good match for Exponential. If these digients were going to be products, the potential profits might be worth the risk. But if all they're going to be is employees, that's a different situation; we can't justify such a large investment for so little return."

Of course not, she thinks. Who could? Only someone who's a fanatic, someone who's motivated by love. Someone like her.

#

Ana is sending a message to Derek about the failed meeting with Exponential when the robot body comes to life. "How meeting go?" asks Jax, but he can read her expression well enough to answer the question himself. "Is my fault? They not like what I show them?"

"No, you did great, Jax. They just don't like digients; I made a mistake in thinking I could change their minds."

"Worth trying," says Jax.

"I suppose it was."

"You okay?"

"I'll be fine," she assures him. Jax gives her a hug, and then walks the body back to the charging platform and returns to Data Earth. Sitting at her desk, staring at a blank screen, Ana contemplates the user group's remaining options. As far as she can tell, there's only one: working for Polytope and trying to convince them that the Neuroblast engine is worth porting. All she has to do is wear the InstantRapport patch and join their experiment in industrialized caregiving.

Whatever else one might say about Polytope, the company understands the value of real-time interaction in a way that Exponential does not. Sophonce digients might be content to be left alone in a hothouse, but that's not a viable shortcut if you want them to become productive individuals. Someone is going to have to spend time with them, and Polytope recognizes that.

Her objection is to Polytope's strategy for getting people to spend that time. Blue Gamma's strategy had been to make the digients lovable, while Polytope was starting with unlovable digients and using pharmaceuticals to make people love them. It seems clear to her that

Blue Gamma's approach was the right one, not just more ethical but more effective.

Indeed, maybe it was too effective, considering the situation she's in now: she's faced with the biggest expense of her entire life, and it's for her digient. It's not what anyone at Blue Gamma expected, all those years ago, but perhaps they should have. The idea of love with no strings attached is as much a fantasy as what Binary Desire is selling. Loving someone means making sacrifices for them.

Which is the only reason Ana's considering working for Polytope. Under any other circumstances, she'd be insulted by the offer of a job that required the use of InstantRapport: she has as much experience working with digients as anyone in the world, yet Polytope is implying that she can't be an effective trainer without pharmaceutical intervention. Training digients — like training animals — is a job, and a professional can do her job without having to be in love with a particular assignment.

At the same time, she knows the difference that affection can make in the training process, how it enables patience when patience is needed most. The idea that such affection can be manufactured isn't appealing, but she can't deny the realities of modern neuropharmacology: if her brain is flooded with oxytocin every time she's training Sophonce digients, it's going to have an effect on her feelings toward them whether she wants it to or not.

The only question is whether that's something she can tolerate. She's confident that the InstantRapport patch won't distract her from taking care of Jax; no Sophonce digient is going to displace Jax in her affections. And if working for Polytope is the best chance of getting Neuroblast ported, she's willing to do it.

Ana just wishes Kyle understood; she has always made it clear that Jax's welfare comes first, and up until now Kyle has never had a problem with that. She doesn't want their relationship to end because of this job, but she's been with Jax longer than she's been with any boyfriend; if it comes down to it, she knows who she'll choose.

Chapter Ten

The message from Ana about the failed meeting is short, but to Derek it conveys plenty. He's heard the tone in her voice when she has talked about this possibility before, so he knows she's preparing herself to accept Polytope's job offer.

This is Ana's last-ditch attempt to get Neuroblast ported, nothing more. No one likes the idea, but she's an adult, she's weighed the costs and benefits and made her decision. If she's willing to do it, the least he can do is be supportive.

Except that he can't. Not when there's an alternative: accepting Binary Desire's offer.

After his earlier conversation with Marco and Polo, Derek privately contacted Janelle Chase to ask her if the digients' desire to be incorporated wouldn't render them unsuitable for Binary Desire's purposes. She told him that Binary Desire's customers will be free to file articles of incorporation on the copies they've purchased. In fact, if their feelings toward their digients become as strong as Binary Desire hopes, she expects that many of them will do so. It's the right answer as far as he's concerned, but part of him hoped they'd give the wrong one, providing him with a clear reason to refuse their proposal. Instead, the decision remains his to make. His, and Marco's.

He's thought about the argument Ana articulated, about the digients not being competent to accept Binary Desire's offer because of their lack of experience with romantic relationships and jobs. The argument makes sense if you think of the digients as being like human children. It also means that as long as they're confined to Data Earth, as long as their lives are so radically sheltered, they'll never become mature enough to make a decision of this magnitude.

But perhaps the standards for maturity for a digient shouldn't be as high as they are for a human; maybe Marco is as mature as he needs to be to make this decision. Marco seems entirely comfortable thinking of himself as a digient rather than a human. It's possible he doesn't fully appreciate the consequences of what he's suggesting, but Derek can't shake the feeling that Marco in fact understands his own nature better than Derek does. Marco and Polo aren't human, and maybe thinking of them as if they were is a mistake, forcing them to conform to his expectations instead of letting them be themselves. Is it more respectful to treat him like a human being, or to accept that he isn't one?

Under other circumstances this would be an academic question, something he could postpone for later discussion, but instead it ties directly into the decision he is facing here and now. If he accepts

Binary Desire's offer, there'll be no need for Ana to take the job at Polytope, so the question becomes: is it better for Marco to have his brain chemistry altered than for Ana to have hers?

Ana knows what she'd be getting into by agreeing to it, more so than Marco does. But Ana is a person, and no matter how amazing he thinks Marco is, he values Ana more. If one of them has to undergo neurochemical manipulation, he doesn't want it to be her.

Derek brings up the contract that Binary Desire sent on his screen. Then he calls Marco and Polo over in their robot bodies.

"Ready sign contract?" asks Marco.

"You know you shouldn't do this if it's just to help the others," says Derek. "You should do it because it's what you want to do." Then he wonders if that's really true.

"You not need keep asking me," says Marco. "I feel same as before, want do this."

"What about you, Polo?"

"Yes, agree."

The digients are willing, even eager, and perhaps that should be enough to settle the matter. But then there are the other considerations, purely selfish ones.

If Ana takes the job with Polytope, it will create a rift between her and Kyle, one that Derek might benefit from. It's not an admirable thought, but he can't pretend it hasn't occurred to him. Whereas if he accepts Binary Desire's offer, the rift created will be between him and Ana; it'll ruin his chances of ever getting together with her. Can he give that up?

Maybe he never had a chance with Ana; maybe he's been fooling himself for all these years. In which case he'll be better off if he lets go of that fantasy, if he frees himself from yearning for something that'll never happen.

"What you waiting for?" asks Marco.

"Nothing," says Derek.

With the digients watching, he signs the contract from Binary Desire and sends it to Janelle Chase.

"When I go to Binary Desire?" asks Marco.

"We'll take a snapshot of you after I get a countersigned copy of the contract," he replies. "Then we'll send it to them."

"Okay," says Marco. As the digients talk excitedly about what this means, Derek thinks about what to say to Ana. He can't tell her he's doing it for her, of course. She'd feel horribly guilty if she thought he was sacrificing Marco for her benefit. This is his decision, and it's better that Ana put the blame on him.

#

Ana and Jax are playing Jerk Vector, a racing game that Ana recently added to Data Earth; they pilot their hovercars across a landscape as hilly as egg-crate foam. Ana manages to gain enough velocity within a basin that she can jump across a nearby ravine, while Jax doesn't make it, and his hovercar tumbles spectacularly to the bottom.

"Wait me catch up," he says over the intercom.

"Okay," Ana says, and sets her hovercar in neutral. While she's waiting for Jax to ascend the switchback trail along the ravine wall, she switches to another window to check her messages. What she sees startles her.

Felix has sent a message to the entire user group, triumphantly beginning a countdown until humanity's first contact with the Xenotherians. Initially Ana wonders if she's misunderstanding Felix because of his eccentric use of language, but a couple of messages from others in the user group confirm that the Neuroblast port is underway and Binary Desire is paying for it. Someone in the user group has sold their digient as a sex toy.

Then she sees a message saying that Derek was the one, that he sold Marco. She's about to post a reply saying that it can't be true, but she stops herself. Instead, she switches back to the Data Earth window.

"Jax, I've got to make a call. Why don't you practice jumping the ravine for a while?"

"You become sorry," says Jax. "I beat you next race."

Ana switches the game into practice mode so Jax can try jumping the ravine again without having to climb up from the bottom each time he misses. Then she opens up a video phone window and calls up Derek.

"Tell me it's not true," she says, but one look at his face confirms that it is. "I didn't mean for you to find out this way. I was going to call you, but—"

Ana's so astonished she can barely find the words. "Why did you do it?" Derek hesitates so long that she says, "Was it for the money?"

"No! Of course not. I just decided that Marco's arguments made sense, and that he was old enough to choose."

"We talked about that. You agreed that it was better to wait until he had more experience."

"I know. But then I–I decided I was being overly cautious."

"Overly cautious? You're not letting Marco risk scraping his knee; Binary Desire is going to perform brain surgery on him. How can you be too cautious about that?"

He pauses, and then says, "I realized it was time to let go."

"Let go?" As if the idea of protecting Marco and Polo were some

childish fancy he'd outgrown. "I didn't know you thought of it that way."

"I didn't either, until recently."

"Does this mean you don't plan on incorporating Marco and Polo someday?"

"No, I still plan to do that. I just won't be as—" Again he hesitates. "Fixated."

"Not as fixated." Ana wonders how well she knew Derek at all. "Good for you, I guess."

He looks hurt by that, which is fine with her. "It's good for everyone," he says. "The digients get access to Real Space—"

"I know, I know."

"Really, I think it's for the best," he says, but he doesn't seem to believe it himself.

"How can it be for the best?" she asks. Derek doesn't say anything, and she just stares at him.

"I'll talk to you later," says Ana, and closes the phone window. Thinking about the ways Marco might be used — without ever realizing that he's being used — makes her heart break. You can't save them all, she reminds herself. But it never occurred to her that Marco might be one of those at risk. She assumed Derek felt the same way she does, that he understood the need to make sacrifices.

In her Data Earth window she can see Jax gleefully piloting his hovercar up and down slopes like a kid on a trackless rollercoaster. She doesn't want to tell him about the deal with Binary Desire right now; they would have to discuss what it means for Marco, and she doesn't have the energy for that conversation right now. For the moment, all she wants to do is watch him and, tentatively, try to get used to the idea that the Neuroblast port is actually underway. It's a peculiar sensation. She can't call it relief, because of the cost entailed, but it's undeniably a good thing that this enormous obstacle to Jax's future has been removed, and she didn't have to take the job with Polytope to do it. It'll be months before the port is finished, but the time will pass quickly now that the destination is known. Jax will be able to enter Real Space, see his friends again and rejoin the rest of the social universe.

Not that the future will be all smooth sailing. There are still an endless series of obstacles ahead, but at least she and Jax will have a chance to tackle them. Briefly, Ana indulges herself, fantasizing about what might happen if they succeed.

She imagines Jax maturing over the years, both in Real Space and in the real world. Imagines him incorporated, a legal person, employed and earning a living. Imagines him as a participant in the digient subculture, a community with enough money and skills to port

itself to new platforms when the need arises. Imagines him accepted by a generation of humans who have grown up with digients and view them as potential relationship partners in a way that members of her generation will never be able to. Imagines him loving and being loved, arguing and compromising. Imagines him making sacrifices, some hard and some made easy because they're for a person he truly cares about.

A few minutes pass, and Ana tells herself to stop daydreaming. There's no guarantee that Jax is capable of any of those things. But if he's ever going to get the chance to try them, she has to get on with the job in front of her now: teaching him, as best she can, the business of living.

She initiates the game's shutdown procedure and calls Jax on the intercom. "Playtime's over, Jax," she says. "Time to do your homework".